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"I cannot help plead to my countrymen, at every opportunity, to cherish all that is manly and noble in the military profession, because Peace is enervating and no man is wise enough to foretell when soldiers may be in demand again."—SHERMAN.

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THE INFANTRY OF OUR REGULAR ARMY: ITS HISTORY, POSSIBILITIES AND NECESSITIES.

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HISTORY.

THE limits of this paper are not sufficient to even mention the many gallant and devoted achievements of our Regular infantry since the birth of the nation.

We may read history to stimulate national, professional or personal vanity. We may read it to cultivate the mind and garner information; or we may study its lessons for the purpose of avoiding, in the future, the mistakes of the past. Fools may profit by their own experience. It is the highest use of history to teach wisdom from the mistakes of others.

No man ever had a better right to be satisfied with himself and the armies he led to victory, than Marshal von Moltke, the "Battle-Thinker," as his emperor called him. Yet when he returned from each of his phenomenally successful campaigns, instead of vaunting himself and glorifying his army, he sat down at his desk, and asked himself two questions: "In what respect was the army lacking in the last campaign?"—"How can we remedy those defects in future?" In answering these

* Board of Award: Ex-President Grover Cleveland, Brigadier General S. B. Holabird, U. S. Army, and Colonel F. V. Greene, N. G. S. N. Y.

questions, he spared neither high nor low, least of all himself. In speaking of himself, he often says, "The Chief of the Staff should not have issued that order," or, "It would have been better if he had done this instead of that." After 1868, he was very much dissatisfied with the manner in which the artillery had been handled, and used his great influence to correct such faults as: Too few guns working together, and the batteries not pressing to the front with sufficient promptness, during the progress of battle. In the war with France, the artillery showed itself cured of every fault which he had pointed out.

Let us review the history of our infantry in past wars, in the von Moltke spirit of retrospection, finding faults only with the hope of avoiding them in the future.

Our first war was declared against England in 1812. At that time our Regular infantry consisted of seven regiments. This force was too small and too much scattered to exercise an appreciable effect on the war. The great extent of our country, and the lack of means of transportation, made it impossible to concentrate the infantry. Throughout the war, the regiments and separate companies were overshadowed and lost in the multitude of militia and volunteers, which from time to time appeared in the field.

It seems like madness for us to have declared war on a great military and the first naval power on earth, with such a pitifully insufficient force. At the beginning of the war, it was the intention of the Government to make use of the militia, which had been organized with an imposing paper strength, by the Act of 1792. The militia soon demonstrated their utter unfitness for taking a serious part in a foreign war. It is unnecessary here to relate the painful story of their inefficiency, insubordination and frequent unwillingness to fight. They are only pertinent in this article for the reason that the Government used the fact of their existence as an excuse for not maintaining a sufficient force of Regular infantry.

It should have been evident from the first that the militia is not a part of the national armed strength; that is, that force upon which the nation must rely to fight a foreign enemy. There are and can be no limitations to the power of the Government over its army in war. But there are both constitutional

and statutory limitations as to its power over the militia. Section VIII, Article 15 of the Constitution, says: "Congress shall have power to provide for calling forth the militia to execute the laws of the Union, suppress insurrection and repel invasion." It was our policy to invade Canada, that her people rather than ours might feel the sharp edge of war. But the militia declined to cross the frontier, claiming, under the Constitution, that they could be used to repel invasion, but not to invade. In short, the militia is the constabulary or gendarmerie of the States, the reserve behind their civil police. The Constitution and Statutes provide that it shall be at the disposal of the United States, in certain emergencies, for specific purposes, and during brief and definitely limited periods of service. It is evident that such an institution can not be regarded as a military force to be relied on in war.

At no time did we put a sufficient force into the field, during this war, to successfully invade Canada. On the contrary, the enemy invaded our territory repeatedly, captured and burned our capital and several other important places.

In 1812, the population of the United States was about eight millions, and we were possessed of ample means to arm, equip and maintain an army adequate to the occasion. On no battlefield during the war did we assemble five thousand good infantry. Yet Congress authorized the raising of forty-six regiments, thirty-nine in addition to the seven then in the peace establishment. But the system of recruiting was so bad, or, more properly, so lacking, that the organization of these regiments was never completed. In fact, the ranks of the seven original regiments were never filled up to war strength. We read of regiments going into battle with two hundred men, and even less, when they should have had a thousand.

If these forty-six regiments had been organized before the declaration of war, and had they been localized and given a good system of regimental recruiting, the Government would have had forty-six thousand good infantry. With this force, and the proper proportion of artillery and cavalry, we could have invaded Canada, and held every important point until peace was settled. We could also have defended our coast from the incursions of landing parties, spared ourselves the disgrace

of having our capital captured and burned by a handful of British regulars.

Though the navy, small as it was, covered itself with glory, our record on land was painful and humiliating. There is no more disgraceful incident in any history than the battle of Bladensburg, where our troops, in a good position, and with superior numbers, were routed and driven off the field by an inferior British force. This engagement was fought, on our side, by United States troops, State volunteers and militia; but all were equally unsteady and unreliable under fire. The first discharge of Congreve rockets so terrified the militia on the left, that they stampeded and fled like sheep, carrying with them the whole line of battle, in utter rout and confusion.

Personally, the men were doubtless brave enough; but this incident shows that no reliance can be placed on raw levies, hastily assembled, without time to acquire discipline, or learn their duties as soldiers.

The cost of this war is computed at one hundred and seven million dollars. Had we put a sufficient number of soldiers in the field at the beginning, to seize and hold Canada, we might have held it, or demanded an indemnity equal to the cost of the war, as the price of peace.

In the war with Mexico, the Regular infantry numbered eight regiments. Under the most trying circumstances, it showed itself always equal to the occasion. The demands made upon it were often above anything which a general or a government has a right to expect of soldiers; but the Regular infantry always responded with unhesitating and devoted courage. With ranks sadly depleted, short of men and officers, it repeatedly attacked the enemy in strong positions, always outnumbered, sometimes four to one, yet it was always victorious.

Though it was evident from the admission of Texas into the Union, that war with Mexico was inevitable, yet nothing was done to increase or strengthen the Regular infantry.

When General Taylor occupied the disputed territory between the Nueces and the Rio Grande, his command consisted of about two thousand men, principally Regular infantry. With this force, he fought and defeated in two battles, a Mexican army of six thousand.

In February, 1847, Congress authorized the organizing of ten additional regiments of United States infantry for one year.

These regiments had the advantage over other short-term volunteers, that the men were enlisted by United States officers of the army, and not by State civil officials, and that many officers from the Regular establishment were assigned to them, with increased rank. Joseph E. Johnston, then a captain of engineers, served as lieutenant-colonel of one of them. Had these regiments been organized a year or two sooner, they would have formed a valuable addition to our invading army in Mexico; but, unfortunately, they did not reach the field until the war was nearly over.

Recruits were not forwarded to the regiments with any system or regularity during the war. The regiments of General Taylor's army lost 43 per cent. in the first nine months, and received only an insufficient number of recruits several months later.

Throughout the war, soldiers of both Regular and volunteer regiments were discharged, in the field and in the presence of the enemy, on account of expiration of term of service. Very few men discharged, under these circumstances, could be induced to reënlist for the remainder of the war. General Taylor discharged six thousand three and six months' men in the summer of 1846. Out of this number only enough to form one small company would volunteer for the war.

No discharges should be given during the war, except for physical disability. It is absurd to spend time, money and labor in enlisting, drilling and transporting a soldier to the front, only to give him his discharge in the middle of a campaign, and allow him to go home because it is a certain day of a certain month.

The number of men actually sent to the field was most insufficient. The largest force led into battle by General Taylor was 6600 men. At Buena Vista the enemy outnumbered him four to one.

General Scott invaded Mexico with 12,000 men. In nearly all his battles, he was obliged to attack his enemy in strong position and in superior force. After the capture of the City of Mexico, his army was reduced to 6000 men.

It is inexcusable in a rich and populous nation to send forlorn hopes into the field to fight its battles, when there are thousands of men at home only waiting an intelligent and business-like system to make good soldiers of them, and send them to the front.

It was reserved for our last and greatest war to see our Regular infantry reduced almost to the vanishing point, at the time above all others when it should have been strongest and most efficient.

At the first note of war, it is expected that Regular regiments will be filled up to the full war strength, and that later, their losses in the field will be promptly made up by transfer of reserve officers, and by forwarding the necessary number of recruits direct from the depots. But far from this being the case, these regiments sank almost out of existence. This was due, in the first place, to the loss of officers. There were some officers unable to bear the hardships of a campaign, by reason of age or other disability. Most of the Regular officers left their regiments to accept higher commands in the volunteers. These places were filled by men fresh from every civil calling, without any military education or training. So that in a short time, the Regular regiments had little or no advantage over the volunteers as regards officers.

It is certainly not our policy to keep all good officers in the Regular establishment after the outbreak of war. Many can serve the country better in other capacities. But the vacancies in the Regular regiments should be promptly filled by men with some knowledge of military affairs.

In the second place, the most serious disadvantage under which the Regulars labored was the impossibility, under the then system of recruiting, of getting men to fill the ranks. This was due to several causes. The most important was the President's calling on the Governors of States for volunteers, and fixing the number to be raised by each State, so that each Governor was interested in having every man who went to the front from his State, credited to his volunteer account. For some reason, States were not credited with enlistments for the Regular army. Thus, the Governors became an obstacle to enlisting in the Regulars, and an intermediary for enlisting in the volunteers.

One of the most baleful results of this system was that in many cases, the efficiency of the army in the field was sacrificed to the exigencies of State politics. It was the deliberate and persistent policy of most of the States not to send recruits to make good the losses in the field; so that in a short time after a regiment went into active service, it became so reduced in numbers as to greatly reduce, or entirely destroy, its efficiency. This was good State politics, for it gave the Governors the patronage of raising new regiments, and appointing new officers. There were only two States which habitually kept their regiments up to war strength. General Sherman says that one of these regiments was worth half a dozen of the skeleton regiments furnished by political recruiting.

Another cause of difficulty in filling the ranks was the fact that the States generally paid higher bounties than the general government. Men naturally enlisted where they got the most money.

The bounty system grew out of the practice of apportioning volunteers to States, with their Governors acting as recruiting officers. The Governors wished to be popular. It was more popular to give money than to use force to compel enlistments. After the bounty system was thoroughly planted in the States, the general government was forced to follow their example, or get no men at all for the Regulars.

It is greatly to be hoped that the Government may never again be so weak, or national patriotism so low, as to require the payment of a bounty for military service.

The system of recruiting was another source of trouble. General recruiting for the army was attempted, and it worked very badly. The experience of the civilized world, in late wars, has demonstrated that a system of regimental depots, which enlist, drill and train the recruits, and forward them direct to the front, as needed, is the best, if not the only, practical method of recruiting an army in war.

The history of the Second Infantry, in this war, is a striking example of the ruinous effects which resulted from our faulty methods of supplying both officers and men to regiments in the field.

In July, 1864, the Second Infantry had seven officers and

thirty-eight men for duty. Its full authorized strength was thirty-five officers and one thousand men. At that time, the regiment was serving in the Army of the Potomac. Reduced to this pitiable state, all the officers and men were transferred to Company C, which was assigned to duty as provost guard at Division Headquarters. Shortly after this, the regiment, in the midst of the most desperate and final campaign of the war, expired as an organization in the field, and disappeared from the rolls of the Army of the Potomac. Recruiting parties, representing in name the several companies, were distributed through the various States, and strenuous efforts made to fill the ranks. But it was not until July of 1866 that the regiment was able to resume its proper duties, and even then, it was thirteen men short of its authorized strength.

From this brief retrospect of the history of our infantry, we may formulate the lessons to be drawn from the most salient faults in our war methods, as follows:

1. Never declare war until thoroughly prepared to fight it through to an honorable and advantageous peace in the shortest time possible.

2. Not to regard the militia as a part of the national armed strength, but recognize them as the constabulary or gendarmerie of the States;—a most important force, on whose courage, fidelity and discipline much may depend in troublous times.

3. Take the greatest number of men in the field which can possibly be needed, according to the most liberal calculations. Better ten times too many than one too few. If victorious, we will make the enemy pay the entire bill.

4. The United States must recruit all men for military service through its own officers, and not delegate this important duty to State authority. Recruiting is the first and most important step in the "Raising of Armies";—a power expressly and exclusively given to the general government by the Constitution.

5. Regiments must be raised to the maximum authorized strength, in men and officers, at the outbreak of hostilities, and kept full throughout the war. To this end, a reserve list of officers and men, and a recruiting system based on regimental depots, is necessary.

6. No man should be discharged during war except for physcal disability. All enlistments should be for three years, or the duration of any war in which the United States may engage.

POSSIBILITIES AND NECESSITIES.

It is possible for us to have the best infantry on earth. But we must organize, discipline and train it in peace. Troops hastily collected, and only half organized and drilled, after the outbreak of war, however excellent the component individuals, are nevertheless utterly unreliable under fire, and to send them into battle against a good modern army is simply wholesale murder.

Our first necessity is a good code of military laws. These laws must be founded upon, and conform to, the character of our people, and the social and political nature of our institutions. This code must set forth in detail,—first, the exact steps by which the army is to be mobilized; second, the entire scheme for recruiting, for Regulars and volunteers, should be carefully worked out in peace, and fully embodied in laws and regulations. This should constitute the first chapter of a book to be known as the United States Field Service Regulations.

In addition to the above, these regulations should fix the composition and strength of all command units, to include the army corps, and should give general instructions as to the methods by which our troops shall be trained in peace and fought in war. Such a manual is of great importance to any nation facing the possibility of ever being forced to put a large army in the field. It is the most practicable means of securing uniformity and concert of action among officers of every grade, in manœuvres and battle.

All first class powers except the United States possess in some form such a code. In Germany, France, Russia and Italy, it is known as the Field Service Regulations. These nations have expended much time, labor and experiment on the perfection of these manuals.

The smaller our Regular army, the greater will be the number of volunteers which we must employ in war, and the more imperative the necessity for complete understanding and

concert of action among their numerous officers and men, with little or no previous training.

These regulations should be brief. It is only necessary to fix and explain the ways and means by which the entire defensive and offensive power of the nation shall be developed and used in case of necessity. Not only every soldier, but every citizen who is liable to become a soldier, should thoroughly understand these questions before the outbreak of war.

The infantry must have an organization suited to the requirements of modern war. Our present ten company, one battalion regiment was a good organization in the days of close order fighting, with short range muskets; but it is obsolete, and unsuited to fighting in dispersed order, with long range rifles.

For more than ten years, the Secretary of War and the General of the Army, frequently endorsed by the President, have recommended the adoption of the regiment composed of three battalions, of four companies each. So much has been written and said on this subject, that it is unnecessary to repeat the arguments for and against the various infantry organizations. This question, on which so much ink and temper has been expended, may be briefly summed up as follows:

We should abandon the present infantry organization, because it is obsolete. It is the ancient and honorable comrade of the smooth-bore, muzzle-loading musket.

We should adopt the three battalion organization for the following reasons:

First, because the officers of the Regular infantry are almost unanimously in favor of it. As a class, they are better qualified than any other, both theoretically and practically, to form an opinion on this subject. If they are fit to hold commissions in the United States Army, their opinion on a professional question of the highest importance should be worthy of consideration.

Second, because our drill regulations are written for the training and fighting of a three-battalion regiment, and the War Department has for some years practically adopted this organization, as far as it is possible to do so with regiments having only eight manned companies. But as yet, this action is not recognized by our Statutes.

Third, because nearly all the States have organized their guards in three battalion regiments, and for years have been drilling them according to the United States Drill Regulations, especially adapted to that organization. If this organization is not legally and definitely adopted, the members of the National Guard, the largest body of citizens in our country personally and actively interested in army matters, will naturally feel discouraged.

After the infantry is provided with a suitable, modern organization, the next step is to fix the details by which it shall be recruited. It is in every way objectionable to have one system for recruiting in peace, and another for war. Whatever system is adopted for war should be used in peace, with only such modifications as the difference in conditions may necessitate.

We have seen that general recruiting for the entire infantry service has proved itself a total failure. Therefore, let us adopt in its stead a system of localized regimental depots.

This system operates for the good of the military service in two ways: When the men of a regiment are from the same State, and of a company, from the same county, or community, and are more or less known to one another, every soldier will carry with him into the field the restraining and inspiring influences of local public opinion. It is well known that this is one of the most powerful influences in shaping the conduct of individuals in all communities. Human nature undergoes no radical changes in uniform and under arms. It will be a great incentive to a man to be sober and brave, if he knows that his comrades will write home an account of his conduct, which will be known to his friends, parents and sweetheart.

Where organizations are localized, the home communities take the deepest interest in their soldiers, and in many ways, afford them moral and physical support and assistance, which would be impossible with the men scattered throughout the army.

Recruiting officers should always recruit for their own regiments. If an officer does not strive to get the best men possible, his colonel and his comrades will be the first to know it. Regimental feeling is strong in all armies, and it should

be the policy of the Government to cultivate it in every proper way.

We have seen the ruinous effects of delegating the recruiting of soldiers to State authorities. The President is not empowered by the Constitution or any law to call on a Governor to furnish him with men to fight a war, duly declared and recognized by Congress. Every citizen lives under two governments, the national and the State. Each of these is a government of limited powers, but, within its constitutional limits, is absolute and supreme. Each acts directly on the citizen, without the mediation or interference of the other.

The war power is entirely under the national government. The States, and the Governors, as such, cannot be parties to it. They have no vote in declaring war or in making peace. Under the history of a government of limited powers, the President can only give orders to officers and citizens of the United States, in their capacities as such, and in the execution of the laws of the United States. If, then, the President calls on a Governor for militia, volunteers or anything else, it must be an extra-constitutional act. It cannot be an order; it must be a request or an invitation, which he is equally free to accept or decline.

Even were the constitutional aspect of the question different, yet the practice of inviting or requesting Governors to furnish men for war, is, from every sound principle of business, civil and military administration, indefensible. It is an ancient adage that too many cooks spoil the broth. If we should follow this policy in our next war, we should have a President and forty-five Governors dividing up the most important feature of the war power—the enlistment of soldiers.

Not being an officer of the United States, a Governor cannot be forced to coöperate in executing its laws. But the very fact of being invited to assist makes him an important factor in the war-making power, clothes him with the ability to obstruct the enlistment of men, a power which he could not otherwise usurp, without laying himself liable to prosecution for treason.

In addition to the constitutional and legal objections to this system, the following reasons may be cited why it should never again be employed.

When Governors and their civil deputies undertake recruiting, their first and principal object is to fill their quotas, to balance their recruit accounts with the general government. They are apt to regard numbers more than quality of men. Not being soldiers, they do not know what moral and physical traits are necessary to make a good soldier. Physical strength, moral force and character, are as desirable in soldier material, as in that of any other calling. Thousands of most unsuitable men, whom no careful, conscientious officer would ever think of enlisting, were mustered into the service during the war, some of them several times, and many of them are now drawing pensions for services which they were never properly able to render.

But it is a different question when an officer enlists men for his own regiment, whom he may have to lead into battle, and on whose intelligence and courage his reputation and life may depend.

There is no finer soldier material on earth than the better class of intelligent, self-respecting, courageous American citizen. But we also have a large number of citizens incapable of ever becoming good soldiers. It is a matter of vital importance with which of these classes we fill our ranks. With one, we can confidently face the best infantry in Europe; with the other, the honor of the flag, the integrity of the nation, will be in the greatest danger.

The Army Register gives seven millions as the number of men in our country capable of bearing arms. It is not possible that we could ever need or use the entire number in war. But the duty of selecting the necessary number, is a matter of the greatest importance, and should only be confided to those having the deepest knowledge and interest in its faithful discharge.

We must know with what class of men our ranks will be filled before we can write our drill regulations, or adopt our attack formations. The question of leading good soldiers into battle is a very different one from driving poor ones on. In both cases, the methods must be carefully adjusted to the men employed.

The most striking instance of changes in a short period, in battle formations, is that furnished by the armies of Napoleon.

In his first campaigns, his ranks were filled with the better element of the middle and lower classes. People who had suffered great wrongs from the crown and the aristocracy, and who felt in every battle that they were fighting a national war, and avenging personal injuries. With such troops, Napoleon followed the general progressive march in tactics, namely, the diminution in the thickness of lines, and the depth of columns. All his early victories were gained by comparatively thin lines. But after he became an Emperor, and his wars assumed a dynastic and personal, rather than a national character, this spirit and this element, to a great degree, disappeared from his army, and their places were filled by conscripts and mercenaries. To meet these altered conditions, Napoleon entirely changed his attack formations. At Wagram, he massed the entire infantry of an army corps in the deepest and densest column known to modern war, with which he broke the Austrian line by mere force of momentum and impact. The rear of this column was closed by regiments of cavalry, charged with the duty of discouraging straggling by sabre cuts and thrusts. This herd-formation gained a victory, but at a fearful loss of life.

The Wagram column would be impossible to-day. Modern infantry and artillery fire would destroy it as soon as it came within range. With us, it is simply a question of enlisting men capable of fighting in dispersed order, or of facing certain defeat.

In order to immediately fill the vacancies in Regular regiments, at the outbreak of war, caused by the unavoidable detail of many officers on detached service, a reserve list of officers should be authorized by Congress, and kept by the War Department. This list could be made up of those who resign, many of whom would gladly serve in this capacity, from officers of the militia, from meritorious non-commissioned officers, and from graduates of colleges having a military department. We have one hundred officers detailed at colleges and schools. The rank of reserve officers, in peace, should not be greater than captain. They should be required to pass an examination on entering and on promotion, and also to serve with troops for short periods, fixed by regulations. A reserve officer transferred to a regiment, should enjoy the same opportunities for promotion as

any other. In this way, the Regular regiments could take the field at the beginning of a war with the full complement of instructed, trained officers.

The arms and equipments of our infantry are probably as good as those of any other nation. The entire subject of magazine rifles, small calibres and smokeless powder, is still in the experimental stage, as no great war has occurred since the leading nations have armed themselves with this weapon. But we are strangely behind the rest of the world in two important particulars,—an intrenching tool, and an infantry ammunition wagon.

The most characteristic feature of our late war was the frequent use and wonderful development of hasty intrenchments by both armies, both on the defensive and offensive. We were the inventors and instructors in this new phase of modern war. All Europe has learned the lesson from us. In all her armies the intrenching tool is considered as indispensable a part of the infantryman's equipment as his rifle. With the one, he saves his life; with the other, he kills his enemy. Yet we are the only first class power whose infantry is to-day without an intrenching tool. We should lose no time in adopting one, and in accustoming our officers and men to its use.

Of late years, all military nations have striven in every way to increase the rapidity of infantry fire. The supply of ammunition on the battle-field has always been a difficult problem. The difficulties are now greatly increased by the capacity of modern arms to consume ammunition. It is absurd to adopt a magazine rifle, and take no steps to supply the increased number of cartridges necessary to its use in battle. All nations making any pretense of keeping abreast of modern improvements and necessities, except ourselves, have adopted special infantry ammunition wagons, and have carefully worked out a system by which cartridges are to be supplied and distributed during battles. This is a matter of the utmost importance, and should receive the immediate attention of the Government. When an ammunition wagon is adopted, every regiment should have a sufficient number issued to it, and the regiment should be no more separated from them than from their rifles.

One of the most difficult duties which addresses itself to the military administration of a nation, is the training of an army

in peace, so that it may go to war without unnecessary and stupid waste of life, in the solution of the ordinary and ever-recurring problems which present themselves to all soldiers in active service. War training is entirely different from drill. The best drilled troops in the manual of arms, and in accurate parade-ground evolutions, may be very deficient in practical training for war. The Prussian army which Napoleon destroyed at Jena was probably superior to his in precision of drill. Good drill is necessary to the production of good soldiers; it is the mother of discipline, the school in which officers learn to command, and men to obey. But it is only the means to an end. The object of all organization and training is to make the most of men in battle. War training deals principally with officers. It is taught in general by field exercises, manœuvres, and the study and practice of the war game. It should teach officers of all grades how to secure their commands against surprise on the march and in camp; how to get the best results from the combined action of the three arms, and, finally, the principles of attack and defense under varying conditions. A special chapter of the Field Service Regulations, already suggested, should be devoted to this subject.

Since we have been a nation, we have always maintained a small military establishment. We often hear it asserted in Congress and the press that it is our settled policy to keep a small army, capable of being expanded in case of need. This is a sound and excellent theory, but there is nothing new or distinctively American about it. No nation keeps constantly under arms the entire force with which she intends to take the field. Every nation in Europe has organized its army on the same theory. Germany, with five hundred and eighty thousand men with the colors, can expand this force to three million men, in case of necessity.

Let us now suppose that the necessity occurs to-day to expand our army.

To bring this question home: In how many days should we be ready to put our Regular infantry in the line of battle, with the assurance that it has everything necessary for immediate action, men, officers, and material? This is passing from the peace to the war footing.

The first difficulty which we encounter is that the Government has not fixed the number of men which shall constitute a company or regiment on a war footing. This is a matter of prime importance. Until it is done, we cannot furnish the arms and uniforms for the reserve, or determine the number of wagons necessary to transport the ammunition, rations, tents, etc., for the various organizations. There is a tradition and general idea among us that a company means a hundred, and a regiment a thousand men, on a war footing. If this is to be our organization in war, it should be clearly and positively stated in laws and regulations. There is no mystic signification in the number of men which forms the various command units; but it is essential to have these points thoroughly understood in peace, and in war, to have such a system as will keep the organizations filled up to their maximum strength.

In regard to the number of men in a company, it must be borne in mind that a great number of small commands increases the difficulty of administration and handling in action. Again, the element of economy comes in. It is inexcusable waste to pay a captain and two lieutenants to command fifty men, when they could just as well command two or three times as many.

The Germans, with probably what is the best system of recruiting in the world, in the war with France, brought, on an average, a hundred and eighty men per company into action. The war strength of their companies is two hundred and fifty men. With an iron discipline, and a splendid system of recruiting, the Germans brought only seventy-one per cent. of their companies under fire. Applying the same ratio, if we intend to bring one hundred per company into action, our war strength should be not less than a hundred and fifty. All our calculations should be based on the number of men to be brought into battle, not on the number to march out of our garrisons and camps.

The number of companies and battalions in a regiment should be fixed and known. Officers and men should have practice in drilling and manœuvring in the organizations which they will use in battle. But this important point is even more hazy and nebulous than the war strength of a company. There

are three different organizations, in either one of which we may fight the next war. The statutes provide for infantry regiments of ten companies. But there is not one such regiment in the United States to-day. The President, for good and sufficient reasons, by virtue of his prerogative as Commander-in-chief, skeletonized two companies in each infantry regiment; so that now, in the whole army, there is not a solitary soldier in I or K company of any infantry regiment. In addition to this complication, the Infantry Drill Regulations, promulgated by authority of the Secretary of War, provide for the training and fighting of twelve-company, three-battalion regiments. Probably no corps of officers belonging to an enlightened, progressive nation, ever confronted a similar dilemma concerning a vital professional question. If we go to war to-morrow, no infantry officer knows if he must fight in the *de jure* or the *de facto*, or per drill regulations organization.

Assuming that the question of the war strength of companies and regiments is definitely and positively settled, we are then in a position to pass on to the consideration of other points.

To return to the time in which we should mobilize our infantry, we should be able to accomplish this in seven days. This limit is assumed because the average packet steamer crosses the Atlantic in that time, and many of them in less. Should the enemy act secretly and promptly, it would be possible for him to place one or more army corps on our frontier in one week after we were apprized of his hostile intentions.

We are in the habit of regarding the ocean as a barrier to any aggressive operations against us. On the contrary, it is the best possible road to a nation possessed of a numerous merchant marine. There is no limit to its carrying capacity. The greatest merchant marines on earth are those of England, Germany and France. They all know the war strength of their companies and regiments. And moreover, they have worked out, and know to the hour, the time necessary to mobilize and embark their troops.

Let us divide the mobilization into those steps to be taken in peace, and those after the order to mobilize has been issued. In peace, we must arrange for the supply of officers, men and material.

THE OFFICERS.

The Regular regiments must take the field with the full complement of officers. When the Regulars are mobilized, it is fair to presume that there will be at the same time a call for volunteers. In this case, a number of officers from the Regular establishment will be needed to assist in the organization and early training of these volunteers. Their places can be immediately filled from the list of reserve officers already described.

THE MEN.

The present strength of infantry companies is sixty-five men. If we mobilize with a hundred men to a company, each company must immediately have thirty-five additional men. Raw recruits will not do. Such a percentage of recruits would endanger the discipline and steadiness of the best troops. Where are we to get the men? We must establish an army reserve, composed of discharged soldiers of good character and sound physique. One-third of our army is discharged annually, after serving three years. The majority of them go back to civil life. We need twelve thousand to fill our regiments. There are many more than this number scattered throughout the country, who would willingly come back to the colors in case of need. It is only necessary for the Government to formulate a system to compass this end. Some such system as the following would accomplish the desired result.

First, we must establish a certain number of mobilization depots throughout the United States, preferably at those military posts near the great railway centres. Whenever a good man is discharged, let his captain ask him if he wishes to reënlist in the reserve, for five years. If he volunteers for this service, let him be regularly enlisted, and take an oath similar to that prescribed for service with the colors. The captain should then forward the enlistment papers, with the man's address for three months, to the Adjutant-General. The man should be required to report promptly any change of address. Each man should receive a certain compensation—say, five dollars quarterly. His pay account and receipt should be in the nature of a quarterly report of address. Every man should be required to report at the depot to which he is assigned, whenever the Presi-

dent or Congress orders a mobilization. It might be also stipulated that the publication of such an order in the local papers would be considered as due notification. As a rule, no member of the reserve need be more than twenty-four hours from his depot. The Government would pay the cost of transportation to the depot.

All enlistments in the reserve, the volunters or the Regulars, should be for a fixed time, or the duration of any war in which the United States may engage. We have discharged men for expiration of term of service in all our wars, and it has cost us thousands of men and millions of dollars. Finally, each regiment must be assigned to a mobilization depot. Each depot should be numbered, and a return of all property in it made at stated intervals to the War Department.

As soon as the mobilization is completed, a regimental recruiting party should be established at the depot, which should keep not less than thirty per cent. of the war strength of the regiment drilled, instructed, and ready to be sent to the front. Whenever a regiment is ten per cent. short of its authorized strength, its colonel should have authority to telegraph for the necessary men to be sent direct to him. In this way, our regiments, instead of dwindling away in the field, as has been the case heretofore, would be always full to war strength, and grow better and better as long as the war might last.

THE WAR MATERIAL.

The soldier, like every other craftesman, must have the tools of his trade in his hands before he can do good work. Of late years, these tools have undergone many radical changes, so that now, they are numerous and complicated.

To carry out the idea of mobilization in the shortest possible time, everything needed to take the field must be either in the hands of, or under the immediate control of, the regiment. War material in great depots will not do. The French demonstrated this in 1870, when the War Minister reported to the Emperor that the army was ready to the last gaiter-button. The immense numbers of wagons on which he relied to furnish the field transportation for the army, were all stored in several vast depots. When these wagons were ordered to be assembled, and issued to

the troops, it was found that many parts were old, warped, rotten and unserviceable. At the time of mobilization, the railroads were so glutted with men and all sorts of supplies, that it was impossible to deliver the wagons to many regiments before they had to take the field. In fact, the French army was never properly supplied with transportation, which greatly reduced its ability to march and manœuvre rapidly. This was one evil of over-centralization. We should have the same experience under similar circumstances.

The German mobilization was in striking contrast to this. With them, each regiment kept all its war vehicles in sheds near its barracks, and used them several times a year in practice marches and manœuvres. When the order "Mobilize" was given, it was only necessary to issue the reserves their uniforms, arms and equipments, and the regiments were able to march out of their garrisons with everything ready for active service.

These arrangements complete the essential steps which can be taken in peace. The reserve officers and men are all assigned to depots and regiments, and the necessary material of all kinds is ready to be issued directly to the men.

Now to put our twenty-five infantry regiments on a war-footing, and double their numbers, it will be only necessary for the War Department to issue an order consisting of one word—"Mobilize."

The reserves living within twenty-four hours of their depots should all report in at least forty-eight hours. There will be no delay about supplies of any kind. No requisitions have to be made out and filled. On the third day, the men should all be in ranks and completely equipped. The next three days must be spent in getting the new men and officers shaken down into place. This is best accomplished by means of drills, and a few simple field exercises. No company is fit to face the enemy until every officer knows every man by name.

The next step should be the organization of brigades. In the next two days, the three or four regiments selected to form a brigade, could be concentrated, the brigade commander makes the acquaintance of his colonels and gets some idea as to handling his new command.

The end of the seventh day should find us with twenty-five

thousand infantry, armed, equipped and organized into brigades. Even with our present inadequate number of regiments, we may increase this force by adopting a three battalion, twelve company organization, and still further by increasing the number of men in a company.

This entire force could not be brought into battle, for the reason that a number of men must be detailed from the fighting strength on extra duty in the supply departments. Under our present system, a regiment would lose a very appreciable percentage by these details. To avoid the absurdity of enlisting, equipping and training a man to carry a rifle, and, as soon as we take the field, putting him to do a non-combatant's work, a special corps of men for the supply departments should be provided. The hospital corps has taken the lead in this matter. It is to be hoped that the quartermaster and commissary departments may soon follow.

We cannot claim to have thoroughly trained and organized infantry, until infantry divisions are organized and manœuvred in peace. The infantry division is the highest development of the arm. It is the giant of battles. It is the true fighting unit of all great armies. A nation with good infantry divisions, already has a good army, for grouping them into corps and armies is a mere detail. In fact, the infantry division is a small army. It is the first organization in which the three arms of the service and the staff are combined, and work together. It should consist of not less than twelve thousand rifles, a regiment of cavalry, and six batteries of artillery, with the necessary engineers and trains. It is only by field exercises and manœuvres with infantry divisions that generals and higher staff officers can be trained in peace to handle large bodies of men, and to work the three arms and the staff in harmonious unison.

First Honorable Mention.*

BASED ON PRESENT CONDITIONS AND PAST EXPERIENCES, HOW SHOULD OUR VOLUNTEER ARMIES BE RAISED, ORGANIZED, TRAINED AND MOBILIZED FOR FUTURE WARS.

By Captain W. A. GLASSFORD, Signal Corps, U. S. A.

THE original policy of maintaining a very small standing army in this country was dictated more or less by the similarity of conditions that obtained here with those in England from which our military policy was derived. Owing to the isolation of these two countries by natural barriers a greater time was afforded for the organization of defense, thus obviating to some extent the necessity of a large standing army. We have now, however, to deal with the locomotive, the marine steam engine and the high power gun; in consequence of these the time available for the mobilization of an army has been much shortened, necessitating a more extensive system of previous preparation.

Modern requirements necessitate the greatest practicable diffusion of military knowledge and training among the people. This is evident when the size of the army that would be required in case of war is considered. Shorter terms of service with the resultant training of greater numbers of men for the armies of Germany and of France exemplify to some extent what is needed in this country where the opposite course is pursued. Therefore, it may be well to preface any examination of the mode of raising, organizing and training volunteer armies, with some considerations relative to the previous military instruction of the volunteer.

It is obvious that the greater the number of trained men available at short notice, the easier the problem of defense becomes. In order to provide a great number of trained men, the

* Board of Award: General Wesley Merritt, Governor U. A. Woodbury, of Vermont, and Colonel H. W. Closson.

army should be made as much as possible the military school of the citizen. This can be accomplished to some degree by the adoption of two means: first, by restricting enlistments in the Regular army to one term of three years, at the expiration of which the soldier would return to the body of the citizens from which he came; second, by largely increasing the number of graduates of the Military Academy and assigning them to cadres, so that there may be, in time of emergency, a greater number of educated officers to become instructors in the military art.

ENLISTMENT IN THE REGULAR ARMY FOR ONE TERM ONLY.

The voluntary enlistment of so great a number as 25,000 men every three years might seem to present some difficulty on account of the small pay which the soldier receives as compared to the remuneration in other pursuits. But we find that the number of men who offered themselves for enlistment in 1896 was 49,000, of whom it is safe to say that 40,000 were men who had never been in the service. It is true that many of these would appear not to have been up to the high standard of qualifications now prescribed for recruits; but the fact is that the vacancies, in view of the large number that reënlist in consideration of the preference now given to old soldiers, are not sufficient for the great number of men who apply for enlistment; hence, men are not rejected wholly because of disqualifying defects but rather for want of places, and so only a few are chosen.

It is, therefore, quite certain that the third of 25,000, or 8333 men, who would be required yearly, could be readily found from the 49,000 who now apply. But it is not wholly upon the class at present found in the army that the main dependence for numbers would rest when reënlistments were abolished. Attracted by the altered conditions herein outlined, many sturdy young men of the nation, bringing with them the education of our system of public schools, would present themselves. And should experience prove that more than the required number of desirable recruits were available for enlistment, the length of service for infantry could be reduced; for it is well understood that the infantryman is more quickly formed than the cavalryman or artilleryman. Or, if the number of desirable applicants were

sufficient, the Regular army might be increased, for a time at least, so as to accumulate as quickly as possible the number of trained men adequate for possible contingencies.

This plan would increase by at least 8333 men yearly the number of drilled and disciplined men in our country. Many of them would become part of the militia of the States and be valuable as instructors therein and in transmitting thereto the habits of discipline acquired in the great military school which the Regular army would thus become. The discharged soldiers leaving the army and mingling with the people would carry with them and spread a military spirit which in its turn would be useful in procuring a better class of recruits for the army. Unquestionably, on the occurrence of war, if such a class of men existed, provision should be made that they receive increased pay in order to call them all out at once; and this could be well afforded in view of the fact that they would not require the expensive and slow training of recruits.

No policy, either national or state, would be offended by a plan which offers the possible realization of the views of our best military authorities as to the method of increasing the army by providing the proper material for the filling to maximum war strength of our present regiments by expansion into an organized and trained army ready to be put into the field as the all-important first line. In time, as the number of discharged soldiers increased beyond what would be necessary for the expansion of our present organizations, independent cadres for this surplus could be formed.

On the occurrence of war, the men then serving in the Regular regiments and also the filled cadres would become in fact volunteers, because these older soldiers of previous service, returning of their own free will to the colors, would outnumber the Regular army, thus eliminating an undesirable distinction in name; for in the minds of Americans and in its best sense the word volunteer has become the synonym for soldier.

If the pay of the enlisted men were increased, especially that of non-commissioned officers, many men would be attracted to the army who now turn from the thought of entering it. Thus some of the best youth of the land might be attracted to the army as a school for the acquirement of habits of study and dis-

cipline, and by the possibility of acquiring a modest start in life by savings from their pay, which the men now in the service find a temptation to squander, well-knowing that they can reënlist.

Moreover, an economy would result from the adoption of a short-service enlistment plan, which would necessarily entail the discontinuance of the retired list for enlisted men which now costs $400,000 per year, and a saving also of the other $450,000 yearly now allowed for "continuous service pay" to those who have served over two years; besides, a saving would result from the reduced number of the class heretofore placed on the pension list on account of disability from long service. The effective strength of the army would, too, be made greater by eliminating the class of men of forty years of age and over who are not now fully up to the requirements but are retained on account of length of service.

The highest education of the military profession should be open to every youth who is inspired to enter it; because it is much easier to educate such a man in the speciality. If a young man can, through the army, enter upon a course which will advance him through the best and highest channels of military education, the country would not lose the martial talent born to it. If the army were made one of the doors of entrance to the Military Academy—which under our plan, would be enlarged—there would be an added attraction to the ranks which would swell the number of enlistments of a more desirable class of men. By providing that a young man, say above the age of 17, with certain qualifications as to moral and physical fitness, could enter the army as an "aspirant" with the understanding that studious habits and recognized fitness to become an officer in his country's army might possibly gain for him selection as a cadet in the Military Academy, such a provision would doubtless attract great numbers, and create among the people a greater interest in the military service.

Long service, which reënlistment permits, tends to create a military class isolated from the life and interest of the country.

It takes that much life from productive channels and forms a considerable class unsympathetic with democratic ideas. Continuous service has been abandoned by the best modern military systems, because costly and deficient in that it trains but a frac-

tion of the force that it is possible to train in the same time and at no greater expense. An example of what short service can accomplish is shown by the system adopted by Prussia when Napoleon put a limit to her regular army. It was by continually taking new men that in a few years she trained an army of citizens who, when wanted, rose to avenge themselves at Leipsic, and who were later able to pursue their enemies beyond the Rhine to Notre Dame.

Under the one-term enlistment plan here proposed, there would be in a comparatively short time a considerable number of trained soldiers ready to enter existing organized bodies and to oppose a hostile force landed on our shores or pushed across our boundaries. A hundred thousand of such men would probably be adequate for the first line of defense, considering the time that would be required for a foreign power to concentrate and maintain on our borders a force larger than could be repelled by this number. While our threatening invader would be thus held back, the second line would be forming under the guidance of competent officers. The men who would form the second line would be volunteers, constituted in part of militiamen, who will be more quickly prepared by reason of the influence of the great body of instructed soldiers who had previously come among them. The patriotism of our people would thus in a great crisis swell our volunteers as quickly as possible, and these would be benefited by the nucleus of trained militiamen.

INCREASING THE NUMBER OF GRADUATES OF THE MILITARY ACADEMY.

The graduates of our Military Academy have, in the main, always organized our armies and shaped our volunteers into the proper military mould, because there were no other persons who understood the details of the necessary preliminary work. This is true of both the Mexican and the Civil Wars.

The paramount need, then, is a large number of officers educated in the military profession, capable of training and commanding soldiers.

But the number that would be needed and that should be available is greater than our Military Academy provides; therefore the scope of that institution should be so augmented as to

provide that in case of war, a sufficient number of officers would be forthcoming. This number would naturally be too great for the needs of the army in time of peace, consequently some of them would, after this introduction to military life, have to be returned to civil life; and this could be done without embarrassment by giving them a rank, or some recognition without pay, subject to call for duty and requiring them, when practicable, to identify themselves with the militia in the states where they reside while retaining their status with the national government; thus giving the country skilled officers capable of organizing the militia into well disciplined volunteers.

Any plan contemplating a large increase of students at the Military Academy should provide for all the graduates a short but supplemental term of service with regiments, during which they would acquire some practical experience in the military profession. The existing law providing for additional second lieutenants would permit the placing in service of 435 such probationary officers. Service with troops would afford those who had been given the advantage of a gratuitous education at the Military Academy an experience that would be valuable to the country whether they continued in the army or went into civil life; for those of the latter class would carry the military system into the militia with which they would doubtless become associated.

After such term of service with regiments, then those needed for the Regular army would be selected and the others would be assigned to cadres within the states in which they chose to reside. Those who go into civil life would do so with no feelings that their military importance would be in any way diminished; for it is scarcely necessary to cite examples of capable and dashing commanders educated in the military profession going into civil life and at the outbreak of war entering our volunteers, and whose careers demonstrated that civil pursuits had not dulled their military proficiency.

At present the number of cadets allowed by law at the Academy is 371, an average of 92 possible graduates yearly. In 1812, 260 were provided for, an average of 65 yearly, when the population was only one-tenth as great as now. This slight increase between the number in 1812 and the present is not in proportion

to the growth of the country or its greater military needs, but is incident only to the increase of the number of Representatives in Congress; although each Representative is constantly standing for an increased number of citizens. The number of cadets graduated has never reached, by a considerable number, even the total allowable under the law; the number seems to have been pruned down to about the number of prospective vacancies in the army open for appointments to commissions. This is contrary to the main idea of its founders and fails of the essential purposes which the Academy can serve.* An expansion proportional to the increase of population, instead of falling behind it, would be more in accord with proper development. In Europe, the spread of military education has, instead of falling behind, expanded in proportion to the increase in population. It is just this fact that should prompt this country to look to the attainment of a similar military end.

On account of the rapid changes and progressive strides in the art of war incident to modern invention, a greater number of competent teachers of the military profession becomes necessary. The educated officers and trained soldiers scattered through communities and identified with the militia can best infuse this necessary knowledge and training into those who would become a part of our volunteers in case of war.

READINESS FOR MOBILIZATION.

Military organization is antecedent to all other questions relative to national defense. In the foregoing have been pre-

* STATEMENT SHOWING, FOR TEN YEAR PERIODS, THE RATIO TO POPULATION OF GRADUATES OF THE MILITARY ACADEMY.

Total number of graduates, for 10 years preceding.		Population of the United States.	Ratio of graduates to population for the 10 years preceding.
1820	209	9,633,822	1 to 46,000
1830	367	12,866,000	1 to 35,000
1840	430	17,069,000	1 to 40,000
1850	435	23,192,000	1 to 53,000
1860	394	31,443,000	1 to 80,000
1870	482	38,558,000	1 to 80,000
1880	508	50,156,000	1 to 98,000
1890	505	62,622,000	1 to 124,000

sented means of giving military training to a great number of the men upon whom reliance for defense must fall. By following the plan which has been outlined a large number of men will have been raised, organized and trained, for immediate service. In providing for calling these into active service, in case of war, as well as volunteers who have not been trained in the army, there are two things to be considered: the *first line* and the *second line.*

The *first line*, consisting of the Regular army and its augmentation by the soldiers who had been previously trained in its ranks, is to be mobilized according to a pre-arranged plan for the Regular army. The problem presented here is for this augmentation of the Regular army at the instant of call. With this object every discharged soldier should be listed and attached on paper to some organization of the Regular army, preferably that stationed nearest his home. This list, if printed annually by the government as a roster of troops, would be valuable for instant mobilization and keep pace with the development of the plan. This roster of soldiers entitled to reënlist in case of war under the special class, would be a roll of honor, secure public consideration for all its numbers, create a pride for the regiment to which they are thus attached, and possible preference in many ways might follow for persons on this list in connection with the administrative departments of the government.

For the mobilization of the *second line*, there must be adopted a national plan, independent of the state militia organizations. This is necessary because the volunteers must be under the commander of the national forces. This can be accomplished by the formation of cadres, the rank and file of which will be filled in case of war by volunteers from the militia and elsewhere; the officers of these cadres to be designated by the President from graduates of the Military Academy not serving in the Regular army—the other officers needed, after the appointment of all such graduates available, to be selected from the militia and civilians found best qualified. These cadres to be distributed through the different states according to population, so that in case of a call to arms all that the states would have to do would be to furnish the apportioned number of men to the cadre organizations already existing

therein. By the existence of such an organization no time would be lost in the work of bringing the force to a proper state of proficiency.

The advantages of such a system will be still more manifest when the fact is considered that nearly all the officers of the volunteer army would be previously known to the staff.

In case of war, the first great want is the trained soldier, to fill the organizations constituting the first line; the second need, the trained officer in sufficient numbers to organize and train the second line. Both would be provided by the system here proposed.

The militia has its place in the system of military preparation, as it serves to keep up a military spirit among the people, and to form an element from which many useful men would be available in forming the second line. This usefulness of the militia in fostering a military spirit is of special importance in this country, on which the necessity for armaments has not been impressed by the bitter lesson of defeat. On account of its geographical position, the people of our country do not keep informed as to the full extent of the armaments taking place elsewhere; and not having experienced disaster in a foreign war they are slow to comprehend the immensity of the military preparations abroad and the consequent importance of war preparation at home.

The militia system may be said to be the constitutional military force of the country. But it is defective as a national institution because it expects more of the citizen than the government seems willing to return any tangible consideration for. And it seems hopeless to expect it to accomplish its purpose until the states devise some means of recompense for militia service. This unsatisfactory condition is indicated by the existence of a militia enactment, over a century old, that contains some requirements so absurd and obsolete that neither the United States nor the states even affect their observance. But when trained soldiers, and men educated to appreciate the military requirements of the country, are dispersed throughout the states there may then develop a sufficient public sentiment to provide the means to make the militia a body worthy of some dependence in a national emergency. A most beneficial result

should ensue to the militia when the educated commander and the trained soldier have become incorporated therein.

The lessons of experience embracing a century when brought to bear on the problems and conditions of the present, indicate that the small Regular army and the neglected militia system fail to supply the necessary means of defense. These same experiences teach that in time of war the volunteer will be forthcoming in sufficient numbers; the question is, therefore, rather one of quality than of number. And any change that can be grafted upon the existing system, that will improve the military organization and prepare the citizen to become a valuable volunteer with little expense would be useful in providing for an army ready for instant mobilization.

The plan of shortening the term of service and increasing the number of graduates of the Military Academy is not a difficult one to put in operation. The increase in expense would mostly occur in the enlargement of the Military Academy. But when it is considered that the aggregate paid in pensions will be gradually diminishing, there appears to be warrant for diverting some of this saving to the military establishment. In this connection it is worthy of note that the policy of the United States in giving many and adequate pensions is doubtless so liberal because it is intended as an assurance that in case of war the volunteer may have no misgivings as to the government's bounty to himself or family in case he is wounded or disabled, or dies in his country's service. So conspicuous is the beneficence of this government toward the survivors of its wars, that abroad it is regarded as a part of our settled military policy. The sums paid to our pensioners plus those paid for our military establishments are taken as the measure of our war power and the expression of our willingness to encourage a military spirit.

The pension system is not the only indication of popular admiration of things military; it is to be noted in the prevalence of military titles and in the numerous orders of brotherhood which adopt resplendent regalia of military pattern. Street processions in military array march and execute movements of drill, all responding to the love of military show and glory possessed by communities the country over. It is perhaps this love

of military rank and the popular approval of military demonstrations that is the strongest incentive to the keeping alive of the militia. That the mass of our people should unite an admiration of these things with a dislike of standing armies seems to indicate that the distrust of the latter is due to want of sympathy between the Regular army and the people. This distrust arises partly from the isolation of the army; it would be much modified the moment it became known that each individual composing the army was, in a short time certain to return and resume his place among the masses of the citizens.

The plan outlined in the foregoing eliminates this distrust and builds up an interest in the army; and it is believed that with arms and equipments provided in advance for an adequate number, the mobilization of a previously prepared force could be most readily accomplished.

RECAPITULATION.

In order to raise a volunteer force for future wars, based upon present conditions and past experience, there is needed:

1st. Short and single terms of service, which will produce a greater number of trained men.

2d. An increased number of graduates of the Military Academy to secure officers.

3d. The previous formation of cadres composed of officers, to be filled up by volunteers in case of war.

THE MILITARY SHOE.

By Major H. S. KILBOURNE, Medical Department, U. S. Army.

ACCORDING to high military authority, the development of the modern infantry soldier ought ever to have in view the fact that the greatest and most important part of the work required of him consists in marching. And it is declared that the success of infantry, and through this arm the success of the entire army, largely depends on its marching capacity. The ability to march is, of course, the net result of physical capacity, training, efficient auxiliary service and other factors which fit the soldier for his work, hold him equal to it, and take him away for recuperation after it is done. Yet it is evident that these factors vary in relative importance. The soldier may, for example, march without a hat, or coat—even without rations in an emergency, but he cannot march effectively without shoes, or something that takes the place of them.

In military literature we may find much about the legs and arms, but little in regard to the feet of soldiers. It appears probable that the feet and footwear of the soldier have not hitherto received the attention which their importance demands. It is quite certain that the foot of the military man has not received the same attention and scientific treatment awarded to the foot of the military horse. We do not find a similar scanty treatment of the other extremity of the body. Much variety has been attained in the head-gear, some half dozen or more different patterns being now worn by our infantry alone. Yet of foot clothing, not counting the stockings, he has, all told, three sorts, but one of which is available for the important function of marching. You will recall how largely, during the Civil War, the army became disabled through foot-sore men. During any active compaign the men strewed the roadsides, encumbered the transportation, and often burdened the hospitals. Whole regiments, even entire brigades, were not rarely *hors de combat* from the accumulating numbers of men so disabled.

The most fruitful cause of this disability is traceable to faulty footwear. Other causes there are, such as malformed,

diseased and tender feet, neglect of the hygiene of the feet, and, in general, the hardships and privations of active service in war. These are contributory, and some of them unavoidable, causes of disability. But unsuitable foot clothing is found to be the most frequent cause of sore feet from marching; a cause probably largely mitigable and avoidable. In an analysis of details we find that the shoe may be defective either in pattern, materials, construction, or adaptability to the wearer. Or, if a fairly good shoe, it may lack requisite preparation for service, or it may quickly deteriorate for want of care.

The regulation shoe cannot be held accountable for all these faults. For even a poor shoe, which it is not, may be made to yield good service by fair treatment. The defects of the service shoe are mitigable, as we shall see. Still, the regulation shoe, considered as an accessory of good marching, leaves something to be desired. Let us consider for a moment what requirements are to be met. The Germans, as you will remember, in training their recruits, practice them in the dismembered step, *i. e.*, they develop the musculature of the legs by a separate exercise of the groups of muscles concerned in the action of marching. We may in like manner analyze the actions of the foot by dismemberment rather than by dissection of its parts. In a study of the human foot we are met at the outset by the fact that this more than any other part of the body is subject to mechanical injury in the exercise of its functions. Sustaining the body weight and especially adapted to its locomotion by an elaborate and beautiful mechanism, it is yet in frequent and more or less violent contact with the earth and obstacles impeding progression. Its capacity and endurance under such conditions are augmented by that which affords protection and fair play to its mechanism and diminished by what impedes its normal actions. The foot also has suffered deterioration in the process of civilization. Observe the foot of a child, yet uninjured by dress, and compare the variety and freedom of its movements with that of an infantryman after a forced march. The loss of activity and of symmetry as well are at once apparent. If a pair of normal feet have their soles covered with a pigment and, when placed together, an imprint be made from them, the resulting composite figure exhibits a symmetrical out-

line not unlike the footprint of a horse. Separated, the opposite sides are seen to be unlike, the inner and outer curves of outline being dissimilar. Each foot is observed to be, not the duplicate, but the counterpart of the other. And the separate foot lacks the quality of symmetry which the shoemaker vainly attempts to restore. Now while the axis of form of the composite figure is a right line the separate axes are compound curves. (Plate I.) The line *a b* drawn through the centre of the heel along the axis of the great toe (Meyer's line) representing not the axis of form but the principal working axis, falls in its

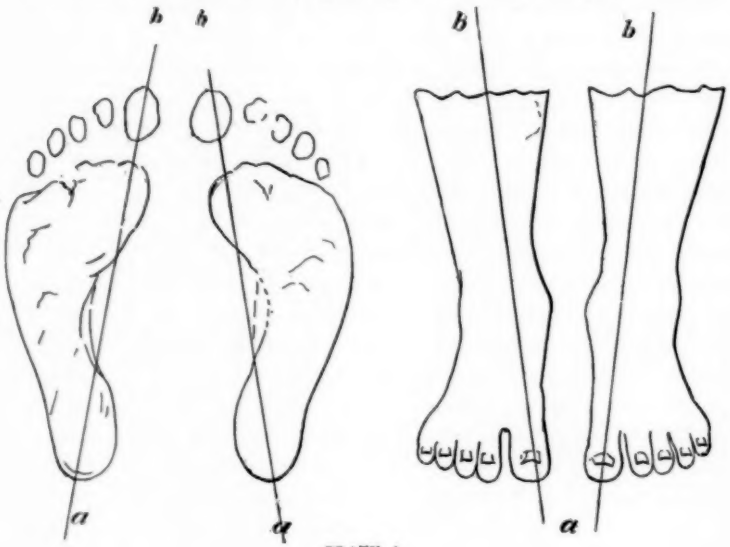
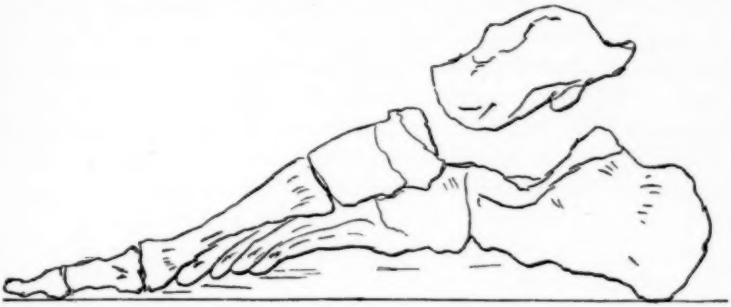


PLATE I.

course partly in the hollow of the foot beyond the normal bearing surface, or tread, passing through the main bearings at heel and toe. Regarding this imaginary line as the main axis, a line drawn through each of the other toes so as to intersect it at an acute angle will represent the auxiliary working axes. Thus differentiated the principal work of the foot in progression is found to be done by the great toe and heel; the subsidiary work of grasping and balancing being the functions of the smaller toes. The hollows of the feet together form a dome shaped cavity below, separating into well-defined arches in shapely

feet, the spring of the arch being longer and higher on the inner than on the outer margin of the foot. The integrity of these elastic arches beneath which lies sheltered a mass of blood-vessels, nerves, and tendons, is maintained partly by the ligaments binding the several bones together, but chiefly by muscular tension exerted through tendons passing from heel to toes along the chords of the arches. The play of the arches under



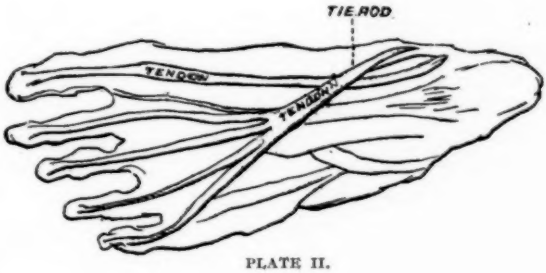


PLATE II.

the pressure and impact of the body weight broadens and lengthens the foot in action. (Plate II.) A failure, or permanent fall of the arch, constitutes that kind of deformity known as splay foot, or flat foot, hateful to mothers and to soldiers. Man alone of all animals is both digitigrade and plantigrade. In standing erect, or in walking, the body weight rests at once, or alternately, on both heel and toes; while in running it is carried on the fore part of the foot only.

The Germans distinguish the "jump step," or *pas de charge* of the French, from the high powered step in which the heel also touches the ground as in the running step of the American Indian. As in running, the bodyweight and impact are borne chiefly on the ball of the foot, the heel being upraised and the toes outspread, and, as in walking the heel is raised before the toes by bending the sole at the ball, the shoe ought to conform to these actions of the foot, *i. e.*, the sole should be flexible and broad at its forepart. (Plate III.) The foot at rest differs in form from the foot in action. In marching pressure broadens and lengthens the foot with every alternating stride. This expansion is due to the yielding of the arch and to the spreading of all the structures of the foot under pressure. The mechanism of these movements may be demonstrated by moistening the

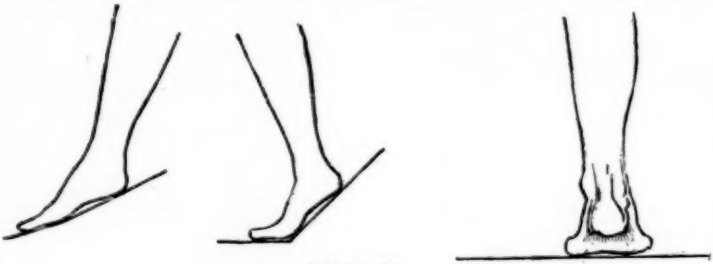


PLATE III.

sole with a pigment and placing the foot on a plane surface between movable perpendiculars placed at the extremities and sides. If then the body weight be shifted over the foot so prepared it will be observed that the obstacles are moved further apart, those at the great toe and outer margin being moved to a greater extent than the others, the excursion being from 8 to 12 mm. longitudinally, and from 5 to 10 mm. laterally, according to the size and elasticity of an adult foot. On inspection of the imprint it also appears that the bearing surfaces, or tread, have been extended in all directions, but mainly laterally toward the hollow of the foot, in such manner as to straighten the inner curve of the outline of the foot when at rest and not sustaining weight. It will also be noted in a study of the contours that as the arch sinks under pressure the foot at the same time rolls on its long axis toward its inner border with a

strain on the strong ligaments of the ankle joint. A similar but greater rocking action may be seen in the pastern of the horse. But the true homologue of the ankle joint appears in the hock of the horse where the human heel is partly reproduced. The relative difference in the modes of progression being that while the man walks on the hock of the horse the horse walks on the nail of the middle toe of the man. The rocking action should be provided for in the pattern and material of the shoe about the ankle in order to avoid friction and interference. If now a tape line be laid along Meyer's line on the bare sole and the heel be raised with the end of the tape and the body weight thrown forward on the ball of the foot, broadening of that part is observed, increasingly, but no lengthening is shown by the tape. The arch in this case is not only maintained but it may, in a supple foot, be shortened by the powerful action of the muscles of the leg the tendons of which replace the heel as a support to the hinder part of the arch. Further observation proves that as the foot rolls and the arch sinks the instep flattens slightly but never completely in the normal foot, this movement being limited mainly by the tendons stretched along and across the sole in a manner, likened by Ellis, to the tie-rods of a bridge*. The thrust of the foot in the act of extension does not appear to cause any perceptible amount of friction on the tread as might be expected.

By actual experiment with the bare feet on a plane surface the bony framework appears to settle and stretch out on the extensible, elastic sole, with no sensible rubbing at points of contact on the tread. The amount of lengthening in an average adult foot in walking is found to vary between one and two ctm., the variations being due to differences of form, size, elasticity and degree of muscular tension. The greater spreading occurs at the toes, the foot being free. The ball widens from six to twelve mm., the instep still less, and the heel only flattens to meet and adapt itself to the supporting surface. The outline figures exhibit the relations of the bones of the foot, the tie-rod action of the crossing tendons, and the change of contour on the tread from a state of rest to action. (Plates II, III.) In order to secure a military shoe of a satisfactory pattern it is now evident that

* "The Human Foot." T. S. Ellis. Reprint, New York, 1890.

the contours of the foot must be followed and the changes of form under different conditions, as far as may be, provided for. We have to deal with the feet of soldiers, physically a select class, from which at the outset many common deformities are excluded. We may accordingly select as a model of the shoe form types of normal feet with the assurance that the footwear shaped upon them will be adapted to a greater proportional number of the men than any other. One acquired characteristic, it is noted, prevails also by inheritance, *i. e.*, that the arch is not prominently developed, and that the instep is correspondingly low—a trait to be allowed for in the model. It is also noted that in the majority of people the foot is more or less constantly and variously deformed and the functions impaired by the custom of shoe wearing. The typical form is to be determined by actual measurements of considerable numbers of feet excluding marked deformations, the limits of variation being thus ascertained. In the transfer of these proportions to the pattern, or shoe last, we enter, with becoming deference, the domain of the shoemaker and his ally the last maker. The exigencies of these arts as well as their traditions must be considered in the construction of the military shoe. These are found to be largely dominated by custom and fashion. The ordinary shoe last differs widely from the true form of the foot, and the so-called anatomical last is either patterned after a deformed foot, or it is the phantom of the shoemaker rather than the vagary of an anatomist. Dr. Irving Ross has with much care and skill made and compared cross sections of a shoe last of the ordinary pattern with corresponding sections of a frozen foot of good form which are here reproduced. (Plate IV.*) The differences are obvious and striking, the outlines showing to what extent the foot must suffer in the process of fitting a shoe made in this manner. The common deflection of the great toe from its normal axis and the excessive "spring" of the last are additional features not shown in the outlines. It is evident from these illustrations that fashion and custom rather than the natural contours of the foot govern the work of these craftsmen.

Consider for a moment the requirements of a marching shoe. It should, in general terms, afford the greatest amount of pro-

* Dr. I. G. Ross—Ref. Handbook Med. Sci. N. Y.: Wm. Wood & Co.

tection with the least injury to the foot of the wearer. Its pattern may disregard custom for utility. More in detail, the shape of the sole ought to conform to the tread of the foot, allowing

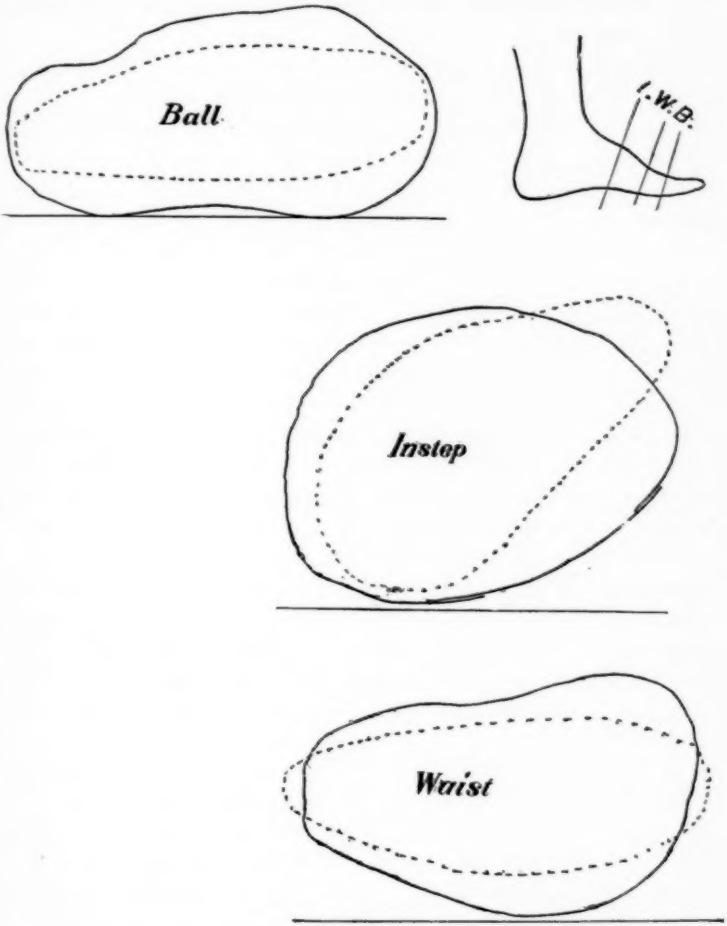
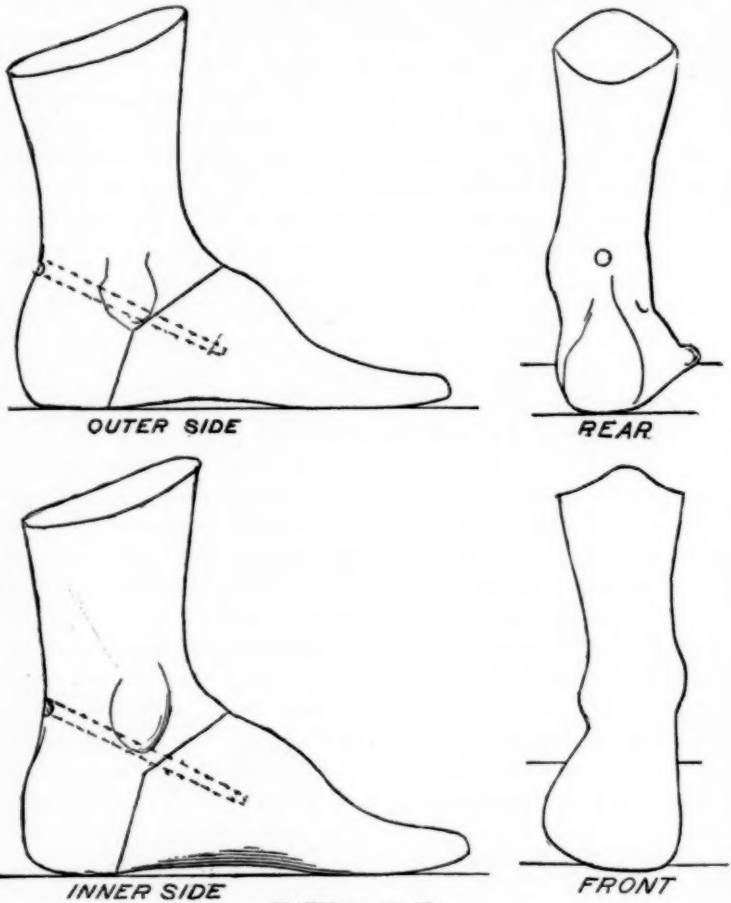


PLATE IV.

for its expansion and protection, and clearing the hollow of the foot. It will be flexible and broad at the fore part. It will be slightly curved from heel to toe and from side to side, avoiding the exaggerated "spring" of the fashionable shoe as disabling

to the foot. A thin sole affords too slight protection from rough surfaces as well as too weak a foundation for a durable shoe. A thick sole, on the contrary, lacks essential flexibility. A single sole of hard, firm leather, best meets these indications, and



PLATES V AND VI.

its edge, especially in front and on the inner margin of the ball and great toe, should be extended beyond the outline of the foot when expanded. The sole ought not to be flat as has been stated by some authorities, on the assumption that the foot is naturally

adapted to flat surfaces. What flat surfaces? The soldier does little marching over asphalt roadways, flagged walks, or rolled lawns, nor does he find American roads generally smooth under his martial tread. No straight line nor plane surface can be found anywhere on the contours of the normal human foot, which possesses in a high degree the faculty of adjustment to uneven surfaces and thus works more effectively than on a dead level. The sole ought to bend into the hollow of the foot, in part only, avoiding contact and interference with the free play of the arch, which by reason of the sensitive structures below it is intolerant of support excepting at its extremities. A shoe heel directly in proportion to its height and inversely to its breadth, by giving the foot a false position, as well as unstable equilibrium, tends to produce deformity and disability. It is a product of habit and fashion having no place in the plan of a military shoe further than to let the foot down, not too suddenly, toward its natural position. It is accordingly reduced to its lowest terms in any well modelled shoe and thus adds to the capacity and endurance of the foot in marching. The mechanical effects of a high heel are seen to be to thrust the foot forward down an inclined plane into the narrow toe usually prepared to receive it, with a consequent cramping of the fore part of the foot, excessive friction and injury. A French army officer proposes to equip the military shoe with a rubber heel,—a device in the direction of improvement on a high heel, but rendered superfluous by lowering, or abolishing it altogether. In natural and easy marching, according to the best authorities, the fore part of the foot first touches the ground to receive the shock of contact.

But a ground plan of the sole is not sufficient to insure a shoe of excellent pattern. As has been stated the contours of the upper surfaces should be followed by the vamp and the ankle and lower third of the leg included in the form of the shoe last. Ellis * insists that the pattern of the vamp should not be the duplicate but the counterpart of its mate, in order to obtain similar results for both in wear. In default of this the stretching and shrinking of duplicates will fail to be conformable in the pair. This is so evident as to need only an allusion,

* Dr. I. G. Ross—Ref. Handbook Med. Sci. N. Y.; Wm. Wood & Co.

yet upon inquiry on this point it appears that the practice is not general among the manufacturers. As in marching the direction of motion is more varied at the ankle than elsewhere in the foot the covering of this hinge joint should be lighter and softer than that below it. In any well shaped and fitted shoe heavier leather may be worn than in default of such adaptation —a matter of economics worthy of consideration. The heel support, or "counter," ought to clear the ankles by a safe margin above its upper edge, it being noted that the outer ankle bone is lower and farther back toward the heel than the inner bone, and, more important still, it should be moulded to conform to the back curve of the heel in order to prevent slipping and chafing—a common injury at this part. The service shoe is nearly straight behind, thus applying a tangent surface to the natural curve of the heel and increasing friction. The "counter" on account of its tendency to turn and present a sharp edge to the foot should be covered, or secured by a suitable lining, or other device. A special last is needed to give the required curve to the heel, so constructed that it may be withdrawn without deformation of the completed shoe. As the foot swells during protracted marching a necessary feature of the marching shoe is a provision for this by adjustment. A laced vamp allows such adjustment and appears to be the best pattern available for this purpose, as well as to provide for differences in the prominence of the instep. The men are disposed to cut the tongue of the service shoe in order to get it on over a high instep, thus destroying the support of the shoe where it is most required. A lining adds to the comfort of the shoe and there appears to be no substitute for leather in this detail. A cloth lining lacks elasticity, shrinks unequally, and quickly becomes foul. Any lining retains moisture with tenacity and is thus far objectionable. A leather lining has been adopted in the proposed model with the view of subsequent modification and restriction to the back part of the shoe, mainly for the purpose of reducing friction to a minimum. A bellows tongue, to exclude dust and moisture, is a desirable feature which also protects the instep from contact with the lacing. The top should reach well above the ankle for the protection of this sensitive joint from contusions and abrasions as well as to keep

the foot clear of mud and water, and, with manifest advantage, is cut higher in front than behind for the protection of the shin bone in the lower third of the leg. The high top in the models enables the soldier to dispense with long trousers in case these *impedimenta* to easy marching should be discarded in favor of a less cumbrous pattern. Further details relating to the quality of materials and workmanship, although of equal importance, are technically beyond the scope of this paper.

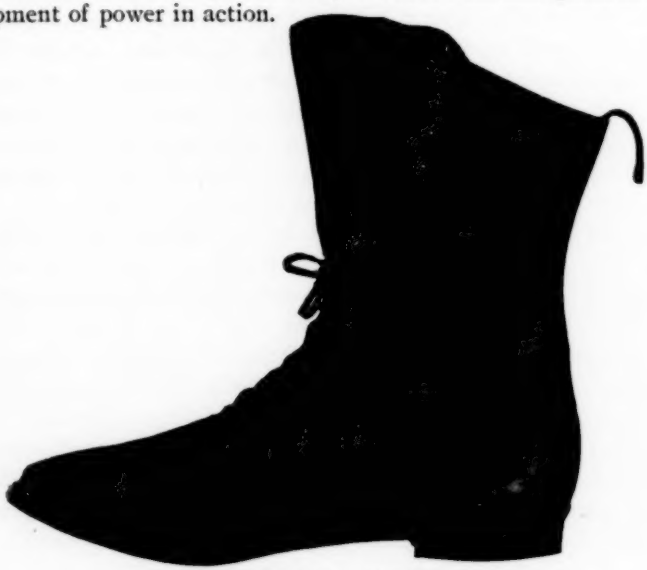
In view of the wide distribution of the troops under varying conditions of climate and soil it appears probable that the campaign shoe should have a corresponding variety. Footwear adapted to the heat and aridity of the Texas plains would hardly yield satisfactory results in the snows of Alaska and on the rainy slopes of the western coast.

A pair of service shoes of medium size weighs 44 oz. avoir. The 'munition boot of the English service has an average weight of 64 oz. the pair, a difference of a pound and a half in favor of the American model. The campaign shoes of the Russian, German and French infantry all appear to be heavier and clumsier than our own pattern, which might be still further slightly reduced in weight with advantage, seeing that every ounce of surplus weight on the foot tells against the maximum efficiency in marching. The defects of the service shoe may in part be overcome by a careful selection and distribution to each soldier from the available stock, and the preparation of new shoes for field service by wetting and moulding them to the feet of the wearer, and subsequent drying and oiling in such manner as to preserve the shape acquired by this adjustment. A recent performance of a brigade of British infantry reported by a medical officer, in the annual report of the Director-General of the Medical Department, is instructive reading as relating to the methods and results of dealing with a heavy shoe.* Yet our own experience will suffice. The young soldier will take the field with new, unbroken shoes, unless prevented, and march into the first camp with raw feet, all in one day. The veteran is more conservative and fortunate, yet inclined to carry about a pair of extra shoes wrapped in a blanket roll, preserved like a sacred relic, or a fetish, with which to propitiate the inspect-

*Army Med. Dep'mt Report. 1895. London.

ing officer on stated occasions of ceremony. Any soldier who has ever experienced the rest and relief afforded to battered feet after days of hard marching by a change of shoes makes good use of a second pair. It is well to have the second pair of a larger size to ease the swollen feet, but any change brings relief that takes pressure off galled spots and transfers it to less sensitive parts.

Summarizing the conclusions reached in the foregoing discussion, we find the service shoe wanting in variety and lacking in adaptability to the foot, notably at the heel and instep, yet the material and workmanship appear to have received much attention. Considering the accessory value of a military shoe as a factor in the marching power of the soldier we infer that a marching shoe of one or more patterns for infantry in the field, would be in the direction of efficiency and the further development of this arm of the service. The medical officer, more than another, is in contact with the casualties of war. He should therefore be more alert and active in their prevention and mitigation. To me, personally, there is attractiveness in the name of light infantry. I would contribute to enhance the well-earned reputation of our infantry for celerity of movement and quick development of power in action.



PROPOSED PATTERN OF A MARCHING SHOE.

WATER: ITS POLLUTION AND PURIFICATION.*

By 1st Lieut. E. E. HATCH, 18th Infantry, U. S. A.

"As a solid, liquid or gas, water is one of the most admirable substances of nature."—Tyndall.

NO subject of social science is of greater importance to the human family than that of its water supply. Its effect on all classes and conditions renders its consideration one of universal interest. The intimate relations clearly established between poor water and disease, and between good water and health, justifies the unrestricted study of the sanitary engineer, and the expenditure of almost unlimited capital in the attainment of a supply of water of health-producing purity sufficient for the wants of all.

This subject of good water is one that very early received the attention of man. Many of the earliest writers discuss its importance. Hippocrates, writing 400 B. C., recommended the boiling and filtration of a polluted water,—advice that would receive the approval of any sanitary engineer of the present day.

Of the different remains of the works of antiquity, none are more interesting than those which show the methods used by the early nations to obtain water. 2000 B. C., the Egyptians, at the upper Nile, constructed an artificial lake, 400 miles in circumference, and to hold a depth of 300 feet of water. This lake, called Lake Maeris, held the flood waters of the great river, and preserved them for the irrigation of the valley. The plains of Assyria and Babylonia, now well-nigh barren, still show the outlines of enormous irrigating ditches, one of which was 400 miles in length and 200 feet broad. Many were of sufficient size to carry the ships of their day. On the site of ancient Carthage is still to be seen the underground cisterns or reservoirs which held the water used by the Punic city. They are eighteen in number, of large dimensions, and are in a good state

* This essay was forwarded, under existing regulations, to the Military Information Division of the Adjutant General's Office, and is published in the Journal of the Military Service Institution by permission of the Adjutant General. The publication of the essay is not to be understood as a mark of official sanction of the opinions expressed therein, the author being alone responsible for the views set forth in his paper.

of preservation. The water was carried to the cisterns in conduits from springs in the southern hills a distance of sixty miles.

All the remains of water systems of antiquity are surpassed in importance by that of the ancient city of Rome. Nineteen aqueducts carried the supply from the sources of different springs. These vast masonry structures carried the water in covered conduits over hills and valleys; frequently throwing it into castella, or settling tanks, for the double purpose of purification, and to reduce undesired head that the water had attained. These aqueducts aggregate 380 miles in length; and so perfect is their preservation that good estimates of their capacity can now be made. Such estimates show that they were capable of furnishing a daily supply of over 300 million gallons; which would give the large per capita allowance of 150 gallons, based on a population of over two millions. Four of the conduits which furnished the supply for the imperial city have been repaired, and to-day carry the water for modern Rome.

The ruins of engineering structures built by the ancients to irrigate vast tracts, and secure bountiful supplies of good water for household purposes are such as to excite admiration for their constructors. When it is remembered that these works were constructed without the aid of electricity, steam or explosives, it must be conceded that in patience and perseverance at least "there were giants in those days."

The source of the entire supply of water upon the earth is a common one,—that of the aqueous vapors of the atmosphere. This vapor, deposited in the form of rain or snow, is at once capable of distinct divisions in accordance with its path of progress in its future course; its opportunities for contamination and change depending largely upon which of these different courses is taken. One portion of the water, thus deposited, runs off the surface of the land as surface water, having but slight connection with the soil; and passes back to the ocean by streams and rivers. Such water has but little contact with the mineral products of the land, but has vast opportunities for contamination from animal and vegetable growths. Another portion of this deposit is evaporated where it falls, and passes back into the atmosphere. Another sinks into the porous soil, and

passes downward until it encounters some impervious stratum. It is nature's vast reservoir; the water table of the engineer. The journey of this portion of the rain and snow fall is a long one in its slow progress of percolation through the soil. It frequently reappears as springs; and is tapped by the various forms of wells. It finally reaches the rivers; and through such outlets, passes on to the sea. Such water comes in intimate contact with the minerals of the earth; it is frequently hard; and varies greatly in its solutions according to the geological strata through which it makes its passage. Still another portion of the rain deposit is used on the surface of the land in the chemical requirements of vegetable growth and decay.

Extensive experiments and observations have been conducted to obtain the percentages of these various dispositions of the rain and snow fall. They vary greatly under various conditions of dryness, pressure and temperature, and the character of the country. The evaporation from woodland soil being from fifty to sixty per cent. less than from saturated soil in the open. The total evaporation for the United States is about forty per cent. of the entire precipitation. Over ordinary water sheds it is believed that fifty per cent. of what remains after evaporation flows off in streams.

For the purpose of discussion and consideration, the water available in its natural condition for man's use may be divided into the following classes with the general designation of their attributes:

Wholesome.	Spring water.	Very palatable.
	Deep well water.	
	Upland surface water.	Moderately palatable.
Suspicious.	Stored rain water.	
	Surface water from cultivated lands.	
Dangerous.	River water to which sewage gains access.	Palatable.
	Shallow well water.	

Before considering these classes, it is interesting and profitable to consider the intimate relation between polluted water and disease; and the propagation of such diseases as yellow fever, cholera, typhoid fever, diarrhœa, and even tuberculosis through the drinking supply of a people. This so-called

"drinking water theory" has been the production of very recent years; and, even at the present time, there is the proverbial disagreement among the doctors and scientists. Yet, while there are many opponents of the water drinking theory of whom Professor Pettenkoffer of Munich is a principal, it is but fair to say that the theory has received almost unanimity of acceptance. It is stated in general terms as follows: Water once polluted with sewage is dangerous; it carries the germs of specific diseases, and is answerable for epidemics of sickness. That each of the various zymotic diseases has a specific bacterium which propagates the disease, the propagation taking place from patient to patient largely by means of water which is drunk, and which was polluted by the dejections of the preceding patient.

WATER AND DISEASE.

Whatever disagreement may exist relative to the exact methods of the propagation of the zymotic diseases, there is now general acceptance of the broad fact that impure water has been the cause of terrible mortality among the human race. Death is its intimate associate. In addition to the epidemics of disease, directly traceable to the water supply, impure water must also be charged with the general impairment of vigorous constitutions that have withstood the attacks of its disease germs, in the same manner as impairment results from impure air.

Water may be impure as the result of containing an excess of mineral, vegetable or animal substances. In the first case, there results a hard water unsuited for cleaning purposes, but generally considered harmless as to disease, except the hardness be excessive. In the case of vegetable substances, either suspended or dissolved, its use is almost certain to produce diarrhœa, especially when first drank by people who are unaccustomed to its use. The use of such water by soldiers in the field frequently results in such general sickness as to impair seriously the efficiency of an army. It is with the third pollution that scientists are chiefly concerned,—the pollution of water with animal products. To this source is traced epidemics of disease that have caused the loss of more lives to the human family than all the wars which have desolated the earth. Such water affords the most favorable opportunity for the growth and

propagation of the germs of disease, as well as furnishing direct transportation for the germs to the human system. It is the breeding place of bacterial organisms; and the general carrier of their death-producing results. No chemical measurements can express its dreadful power, for the devastating effects of such germs is not dependent on amount; no rules can express the time of danger, for their tenacity to life is wonderful, and causes a survival under conditions which might reasonably be thought would produce destruction.

These micro-organisms or germs, known under the general term of bacteria, are found in the bodies of persons sick with disease; and are capable of retaining their vitality for long periods outside of the human body.

The diseases most generally accepted as attributable to polluted water and as being disseminated through its use, are cholera and typhoid fever. A consideration of typical cases of such epidemics show the vitality of the germ organisms, and the lasting danger from water once contaminated with excremental matter of patients suffering from the diseases. We are here outside the realms of abject theories, and in intimate contact with never-failing reality.

In 1843 occurred an epidemic of typhoid fever at the village of North Boston, N. Y. This was long before the connection between the disease and water was recognized. The village consisted of nine families, forty-three persons; and, previous to this time, the disease had never been known. A sick traveller was lodged at the tavern; and died of typhoid fever. The disease spread; and every member of all but three families were attacked. These three families escaped untouched. The water supply of the village was from a shallow well in the yard of the tavern. Its water was not used by the three families who escaped the disease; two on account of distance, the third because of a feud with the landlord. An examination of the well showed the physicians that it was contaminated from the privy of the tavern; but the village people always believed that the well was poisoned by the family that had the feud with the tavern keeper. The case was very clear in showing the relation of water to the disease.

The city of Messina, Sicily, was visited by an epidemic of

cholera in 1887. The population of the city numbered 70,000. In two months there were 5000 cases and 2200 deaths. The population was stampeded; and, at the end of this period, only 25,000 people remained in the city. The water came from springs in the hills; and when collected on the gathering ground was of exceptional purity. It was conveyed to the city in open conduits. The washwomen of Messina, like those of other European cities, do their washing out of doors; and at the nearest available water course. For their accommodation, a portion of the supply had been deflected, and turned into washing pools of stone. The overflow from these washing pools sank into the soil; and its future course thought unworthy of consideration. It was found that this water, after being thus used for laundry purposes, found its way back to the mains, owing to the fact that they were of unglazed tile, badly jointed; and were, moreover, in the immediate vicinity of unglazed tile sewers. The government, thinking that the epidemic and great mortality was due to the water, sent tank ships which brought pure drinking water from the mainland, and supplied the pest-ridden city. Immediately, the plague ceased as if by magic. A more efficient distributing system has since been introduced; and the city has escaped further visitations of the disease.

As illustrating the power of water to carry cholera directly long distances, the outbreak in Genoa, in 1884, is interesting. Cholera was epidemic in surrounding cities for two months; but the officials of the city had given great care to sanitary conditions, with a result that not a case had appeared. This freedom from the disease thus became a matter of much gratification. The disease appeared in an epidemic form at Spezia, only fifteen miles distant, and still, for six weeks thereafter, not a case appeared in Genoa. This result drew praise for the vigilance of the officials; included with which was a report from the U. S. consul eulogizing the watchfulness and the successful sanitary measures. Suddenly the disease appeared; and at once became epidemic throughout the city. The water supply came from three distinct sources. One was a mountain stream flowing through a generally uninhabited country. The water was gathered above the city, and was of excellent quality. It was found that, thirteen miles up this stream, fifteen hundred

laborers were encamped engaged in the construction of a railroad. Cholera had broken out among them. They washed their clothes in the stream; and their bowel discharges undoubtedly found their way to the water. The cholera spirillum was thus at once conveyed to Genoa thirteen miles distant. This source of supply was cut off; the daily deaths immediately decreased rapidly; and in a few days the epidemic was over. The number of cases in that part of the city supplied with this polluted water was over 5000; and in all the other sections 55; these last cases being undoubtedly communicated by the first victims.

The terrible epidemic of cholera which visited Hamburg in 1892, probably received more study and investigation than any similar outbreak. Among others, the celebrated scientist Koch made personal investigations. The results obtained are of intense interest in showing that the disease may readily be abated by attention to the water supply; and, with proper sanitary conditions, may be awaited without fear.

Hamburg, Altona and Wansbeck are practically one city, their dividing lines being imaginary. A stranger could not point out the divisions any more than between districts of the same great city. Hamburg has a population of 640,000, Altona 143,000, Wansbeck 20,000. Being separate municipalities, they each have their distinct water supply. Wansbeck obtains a filtered supply from a lake unexposed to contamination. Hamburg and Altona both obtained their water from the Elbe River; but with this important distinction, that the supply for Altona was filtered through the English sand filter before distribution; whereas the Hamburg water was pumped directly from the river to the mains. In the words of Professor Koch, "cholera in Hamburg went right up to the boundary of Altona and there stopped. In one street, which for a long distance forms the boundary, there was cholera on the Hamburg side, whereas the Altona side was free from it." The results are tabulated:

	Population.	Deaths.	Deaths per 10,000 Inhabitants.
Hamburg, ...	640,000	8,605	134.4
Altona, ...	143,000	328	23.
Wansbeck	20,000	43	22.

The conclusions from the study of the Hamburg epidemic would indicate that the cholera spirillum can be almost entirely removed from water by careful filtration through sand; and the death rate from its use reduced 83 per cent. Further, that if the water for drinking purposes is pure, the much dreaded disease need have no terrors.

Illustrative of the vitality and power of penetration of disease germs, the outbreak of typhoid fever that occurred at the village of Lausen, Switzerland, shows results almost beyond acceptance. The village is at the base of a mountain range; and its water comes from springs which break from the mountain above the level of the village. Typhoid fever became epidemic; and, before it was abated, 20 per cent. of the inhabitants were attacked. The water was found to be polluted; and the source of the poison was traced to a farm-house on the other side of the mountain. Here an imported case of typhoid fever followed by two others occurred shortly before the outbreak at Lausen. A brook ran past the house which received the dejections of the patients; and their linen was washed in it. The brook was used to irrigate some meadows, and the affluent water filtered through the intervening mountain and into the springs on the opposite side. This passage of water through the mountain, carrying the germs of disease, was proved by dissolving one ton of common salt in the irrigating waters of the meadows, and testing the rapid increase of chlorine in the water of the springs. Another experiment was then made, still more important, by mixing uniformly with water 5000 pounds of flour, not a trace of which made its way to the springs, showing that the water was *filtered* through the intervening mountain; and not carried in an underground passage. We have here a startling illustration of the power of water in carrying disease germs. We are confronted with conclusive proof that the typhoid bacilla, from the dejections of the patients, could be carried by percolation through the base of a mountain in sufficient quantity to pollute the water supply of a village.

The different classes of water available in nature for household purposes, and used under the different conditions of availability, are rain water, well water, both from deep and shallow wells, spring water, and the surface water of lakes and rivers.

RAIN WATER.

Rain water is highly aerated; and, when uncontaminated, makes a good supply for drinking purposes. It is seldom strictly pure, however, for its opportunities for contamination are considerable. In falling from the atmosphere, it collects dust laden with impurities; in the vicinities of cities, it collects quantities of organic matter in the air; finally, from the roofs or gathering places it encounters dust, dirt, leaves and the excrements of birds. Attempts are made to avoid largely this last source of pollution by automatic devices which wastes the first water which falls.

It is in the storage of rain water that the greatest dangers are encountered. The water is frequently situated so as to receive gases from sewers; or unprotected from increase of temperature which is productive of the growth of algæ, and other vegetable products. The cisterns are frequently faulty. Slate is the best material, although brick masonry is much used. Cisterns are often constructed in compartments, separated by brick walls, through which the water is allowed to percolate. This practice is condemned. The wall acts only as a strainer; and any strainer which removes harmful products must be so arranged as to admit of frequently cleaning its collections; otherwise, breeding beds are inaugurated which multiply tenfold the dangers already existing. Stagnant water becomes foul, if decomposing organic matter is present; otherwise the water will remain pure. Cisterns should therefore be frequently emptied and the bottoms cleaned. They should be covered, and not so located as to dissolve gases from sewers.

With water is directly associated the question of ice. Ice is now one of the most important articles of household consumption. Incorrect views have been held by the general public relative to the amount of purification which results from freezing, the popular conception having been that complete and perfect purification results.

Careful examinations have shown that only a partial purification results; and that the typhoid bacilla and other germs will live in ice for months. The practice of cutting ice from marshy ponds and stagnant bodies of water is therefore one responsible for much disease, and deserving of the severest condemnation.

Artificial ice is largely superseding the natural product. If the manufacturers would but confine their work to distilled water, its value would be greatly enhanced. From the manner of the freezing, artificial ice must contain all the impurities of the water from which it is made; these impurities being largely segregated in the centre of the cakes,—the portion which freezes last.

WELL WATER.

Well water is of two classes, that from shallow wells, and that from deep or artesian wells. The water from shallow wells, either those that are dug or driven, furnishes largely the drinking supply of the rural districts, embracing a large per cent. of the human race. The water thus obtained has received natural filtration from the surrounding soil; and its purity is dependent upon the character of this natural filter. Generally the water is good and wholesome. Its sources of pollution are neighboring cesspools, manure heaps and graveyards. The carelessness of establishing wells in proximity to these sources of pollution, as a matter of convenience, reckless of danger, is a matter well known, and sometimes amounts almost to criminality. Driven wells are in much favor on the western plains of the United States. A series of such wells, combined so as to be pumped into reservoirs, are used in a few cases to furnish the supply of a city. Such a system furnishes the supply of Brooklyn, N. Y.

The soil of low, marshy sections is wholly unsuited for wells. Such soil has no power of filtration. Years ago wells were used in New Orleans. Dr. Smart, U. S. A., reporting on such wells still in use in 1880, states that some of them were not over ten feet deep with seven feet of water. That the soil filtration did not even remove the turbidity; and that chemical analysis of four wells showed ammonia from organic matter about equal to that contained in the sewage of the city canal. Such cases show the extremes of pollution. The use of these wells was forbidden by law in 1883.

Artesian wells generally furnish excellent water, although often overladen with mineral products, frequently hard, and sometimes holding gases in solution so as to make the water unfit for use. The disadvantages connected with the sinking of artesian wells is the uncertainty that exists as to the supply

that can be obtained, and as to its quality. The work is largely one of chance; although geologists can make predictions of more or less value from the surrounding strata.

SPRING WATER.

Good soft spring water is undoubtedly the best water presented for man's use. Its source is free from opportunities of pollution; the volume is relatively small and can be protected from dangers. This supply has been sought at all times. When it can be obtained for cities in sufficient quantities, it is recommended as a supply by sanitarians. The works of the ancient Romans show that they regarded such water as the only kind fit for drinking purposes. In recent years, the city of Vienna has constructed extensive works to bring water to the city from springs sixty miles distant. Many springs contain sufficient metallic salts to give either fancied or real medicinal qualities. Whatever the character of the spring when the quality of the water is determined it is worthy of reliance, for it is subject to little change. Unfortunately soft spring water is not always available in sufficient quantities.

SURFACE WATER.

The surface water of the land, flowing in rivers and stored in lakes, furnishes a large part of the supply for mankind. The large cities of the world are located on its principal rivers, and convenience and economy point to the river as a water supply. Such water is usually much softer than that obtained from wells; but its opportunities for pollution with organic matter is the greatest of any class with which the engineer deals. The question of the pollution of river water with the sewage of cities has received great study. It is one of the most important studies presented to civilized mankind. To what extent does the pollution of river water by city sewage render it unfit for use? With sanitary experts diversity of opinion relative to the question prevails; with the general public it is given little thought. The people of the rural districts find that the cleaning of uncemented vaults, and the removal of their contents involve trouble and expense; and, hence, in blissful carelessness, allow the contents to percolate through the soil, and frequently find lodgment in neighboring wells; their city neighbors find

the disposal of the sewage a matter attendant with expense, and choose the cheapest method by dumping it all into the river for the river to carry to the down-stream cities, with childlike trust that nature will properly dispose of the filth. Some scientists advocate the entire abandonment, for drinking purposes, of river water which receives sewage. The Vienna Commission, in 1864, rejected all surface water for domestic use. The German Public Health Association, in 1880, after long consideration, pronounced the same decision; but two years later modified their dictum so as to include filtered river water, as fulfilling proper requirements. Professor Petenkoffer and his followers find satisfaction in calculating the minute amount of such products that exist in large rivers under unfavorable circumstances; showing, in general, that allowing the toxical effects of the sewage to be equal to the most deadly poison, it would require the consumption of a gallon of water to produce the same effect as a medicinal dose of strychnine.

Is sewage and vegetable products deposited in a river when unaccompanied with the germs of disease harmful to health? Professor Mallet acknowledges that such water may be used for long periods without apparent injury; but believes that epidemics may result, owing to different periods of fermentation; and, at one period, the water thus be harmless to the human system, at another poisonous, and at still another harmless again. If the zymotic diseases are propagated by water, the opponents of the water drinking theory ask why everyone who uses the water does not acquire the disease. Dr. Sternburg answers that a varying inherited or acquired tolerance for such poisonous products exists with different people.

The amount of pollution that results from sewage varies with increased population of cities along the bank, the rainfall of the basin, and the consequent rise and fall of the water. The change of the amount of pollution with intervening years is serious; and such a water, once pronounced fit for use, may in time become unsuited by reason of changed conditions. The polluting products conveyed to rivers are the excremental matters of the sewage proper, together with the refuse of certain operations as tanning, slaughtering, and the general wastes which are soluble and subject to fermentation. Every city

claims the right to discharge these products in their natural state into the river, in the most economic manner. The general conception obtains that running water purifies itself. Running water does purify itself; but to what extent and under what circumstances? There are but three ways that this purification can take place. By the oxidation of the organic products, by deposition, and by dilution. Careful investigations show that but little air reaches the water of a large river; and the amount of oxidation is insignificant. Deposition in rivers produces varying results generally unimportant. Matter once deposited in the bed is constantly taken up again by increased currents of the water. Water polluted by sewage is purified in a river merely by dilution. That is to say, that the sewage is drunk, with complaisant resignation, simply because it is mixed with large quantities of water.

In the more densely populated countries, the pollution of river water has been much greater than in the United States. Of course such pollution is dependent upon the size and current of the river, the density of population, and many less important conditions. The rivers of England are small, the basins densely populated, and centuries of accumulation have increased the pollution. Unless we except India, they are probably the worst polluted rivers of the world. This fact has become so thoroughly recognized that there has been a general abandonment of the rivers, as a source of water supply; and a new source has been sought from springs and wells in the hills. As an illustration of almost indescribable pollution of a stream from sewage and washings of a soil, Bradford Beck is an example. The river is small and sluggish. Bradford is the centre of a worsted district; and the river receives pollution from dye works, soapsuds and various refuse, together with the sewage of a very populous district. Near the mouth of the stream, sulphuretted hydrogen and other inflammable gases arise in such quantities from the water that children amuse themselves by placing matches on the end of sticks; and, reaching out over the water, actually set the river afire, the flames rising six feet high and running along the surface for yards.

In view of the pollution of rivers by sewage, a pollution which is bound to increase with years, many scientists advocate

the giving up of the larger navigable rivers to the foul purposes of national sewers; and the retention of the smaller rivers and brooks for water supply with their waters guarded from contamination by rigid legislation.

PURIFICATION OF WATER.

Pure water is better than purified water; but it is frequent that the pure water is not available; and the impure, which is at hand, must be made suitable for use by removing its impurities.

The various methods of improving potable water are embraced under the following classes:

1st. Sedimentation.
2d. Filtration on a large and on a household scale.
3d. Clark's method of softening hard water.
4th. Other chemical methods.
5th. Distillation.

Rivers flowing through alluvial soils become heavily laden with suspended matter. This is especially true of the rivers of the central valley of the United States. They all carry more or less suspended matter, regularly or in times of flood. At St. Louis, the sediment has been calculated to amount to 1.8 per cent. of the bulk of the water. It is desirable to remove this accumulation, both on æsthetic grounds and as a measure of health. To accomplish this, it is merely necessary to collect the water in tanks; and allow it to stand quiet for a time, when the suspended matter will more or less completely settle. A popular theory exists that the clay suspended in the water of the Missouri and other rivers adds to its healthfulness. There is truth indirectly connected with the theory. Analysis shows that clay in settling carries down with it considerable quantities of other impurities which are in solution. To think that the clay is an advantage when swallowed in general mixture, along with the other impurities, is of course one of the notions of general folly.

Sedimentation as an auxiliary process, preceding filtration, is frequently employed, and its assistant work is satisfactory. As an independent measure of purification, it is used with good success under favorable conditions. The water supply at St.

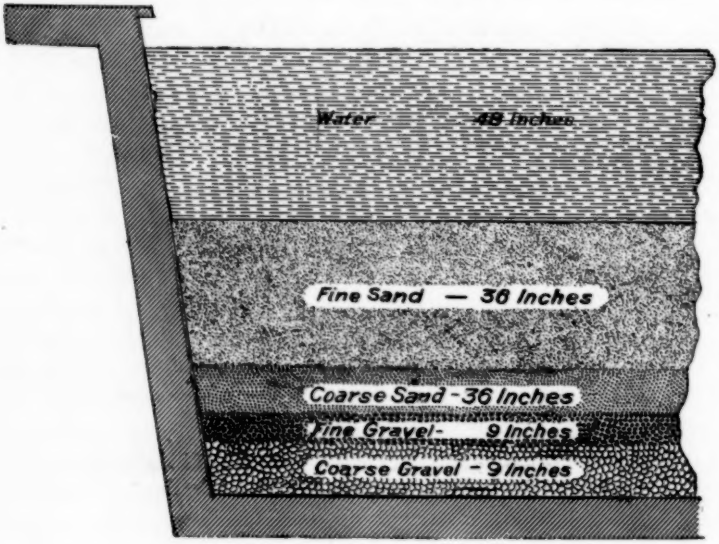
Louis furnishes illustration. Four settling basins, 600 by 278 feet, and 19 feet deep, are used. Their work is alternate; one being drawn from, one being filled and two settling, or one settling, and one being cleaned. These basins have the sediment removed as often as once in four months when about 16 inches is collected. This is floated off with a current of water. The entire cost of this purification is very small.

FILTRATION.

Few cities that have a lake or river supply of water are satisfied with the results of sedimentation; and supplement this work with filtration. This filtration is on a large scale, the work being done before the water is distributed to the mains for consumption. Almost every city of Germany, of considerable size, has adopted this method of filtration. The results are very satisfactory. Of all materials for filtration purposes, sand upon gravel has proven the best suited to the work; and it is now in almost universal use. The arrangement of the gravel and sand is in such manner as to constitute what is known as the English sand filter.

The English sand filter is a tight reservoir, suitably underdrained, and containing six feet of filtering material, commencing at the bottom with six inches of broken stone, then in succession towards the top coarse gravel, fine gravel, coarse sand, and ending with fine sand. Some diversity obtains as to the relative thickness of these layers which will be best adapted to the work; these are matter of detail. The filter bed in use at Altona, Germany, has three feet of sand, followed by three feet of gravel, each material increasing in coarseness from top to bottom. The work of this bed can be positively asserted; it saved Altona from cholera when Hamburg, a part of one and the same city, underwent the worst visitation of the disease known in recent years. It is desirable that the water pass slowly through the filter that the best results may be obtained. To this end, four feet of water is about the proper amount to stand on the bed; this causes the water to pass through at the rate of about four inches per hour. The impurities are largely removed at the top layer of the sand; but the successive layers have an agency in removal; and regulate the flow of the water,

preventing any currents passing through. Any device that takes out organic impurities by mechanical means must have the collections thus obtained removed; otherwise, such a collection becomes a breeding bed and the original germs may be multiplied a hundredfold. This is true for all such filters, whether those used on a large scale for the water of an entire city, or the numerous devices known as household filters. The filter is a strainer; and the impurities gathered by the strainer must be removed. No such mechanical agent can work forever



SECTION ENGLISH FILTER BED.—MASON.

unassisted. It cannot take filthy impurities from water and then clean itself. There are so many people who are always going to do something, and who fail to keep faith with themselves, that engineers are loth to trust household filters with the general public.

As the sand bed filter is used, there gradually accumulates, at the top of the sand, a slimy jelly-like material. This is the strained impurities acted upon by the bacterial agencies. Its rate of growth depends upon the natural character of the water. In from one to three weeks the filter becomes "dead," that is,

impervious to water; and demands cleaning. The usual method is to place workmen with shovels on the drained bed; and remove the deposit from the clean sand. The removal is a simple matter. The deposit at the top of the sand is of such a membranous character that it can easily be skimmed from the clean sand. The sand that is removed is then washed either by playing upon the pile with a hose or with rotary sand washers. The fine sand of the filter is taken thick enough to allow of several scrapings without lessening its efficiency.

The work of this sand filter is shown from the bacteriological examinations of the water used at Altona, in February, 1893, just after the epidemic of cholera in Hamburg. The average number of germs per cubic centimetre in the raw Elbe water was 28,667; in the same amount of filtered water 90; showing a removal of 99.69 per cent. This is only an average result selected from among thousands. Hamburg started sand filters in May, 1893. Their result may well be illustrated by the influence on typhoid fever. In 1892, the death rate from that disease was 34 per 100,000 inhabitants; and that was about its previous yearly average. In 1893, it was 18; in 1894, 6; and in 1895, 8.

A recent report of the Minister of War of France shows the reduction of typhoid fever among that country's soldiers that has resulted from general introduction of filtered water into the garrisons.

The statistics for the whole army is as follows:

	Cases.	Deaths.
1886	7771	964
1887	6130	763
1892	4820	739
1894	3080	530

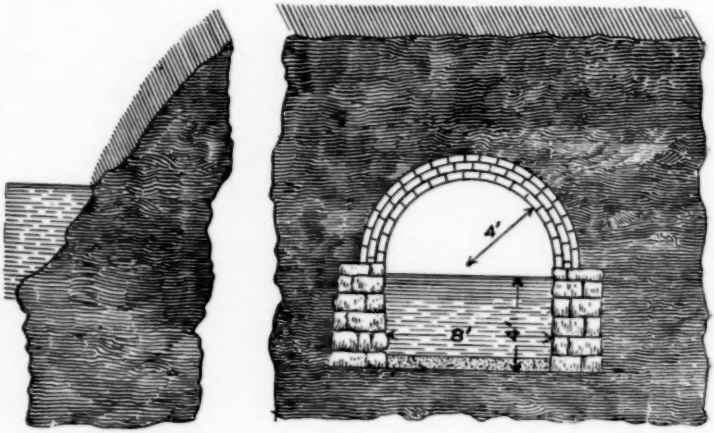
One serious difficulty with the sand filter arises in cold countries in winter. When the water is frozen, it is very difficult to clean the bed. So highly is the filter valued that many cities have solved the difficulties, attendant upon cold weather, by constructing covered filters. The largest and best of such works are at Zurich, Switzerland, and at Warsaw.

Distinct from the method of filtration by the English sand filter bed, is the filtration of water under pressure through lim-

ited sand areas. It is much used in the United States, and is known as the American method. Minute doses of alum, from one-quarter to one-half of a grain per gallon, are added to the water to be filtered, which is then introduced into the filter, a cylinder of boiler iron, three-quarters full of sand. The carbonates of the water act on the alum; and the result is a precipitate of aluminum hydrate, which is jelly-like in appearance, and cleanses the water as the white of an egg does coffee, entangling and dragging down disease germs and organic matter.

This precipitate acts in much the same manner as the bacterial jelly of the English filter bed. The chemical reaction is as follows:

$$K_2Al_2(So_4)_4+3CaCo_3+3H_2o=3CaSo_4+K_2So_4+3Co_2+Al_2(Ho)_6.$$



SECTION FILTER GALLERY, LOWELL, MASS.—NICHOLS.

The water is then forced through the sand; and later the precipitate is removed, and thrown into the waste pipe by a reverse current. The cleansing process occupies but a short time; and the results seem to be equally as good as with the English filter. Many cities of the United States have plants of such filters. The proposed system for Providence, R. I., can furnish 128 million gallons of filtered water per day. Filters of this class are made by many companies under patented appliances. They are made in graded sizes, from a capacity of 4000 gallons, to 500,000 gallons per day. The smallest size, with filtering

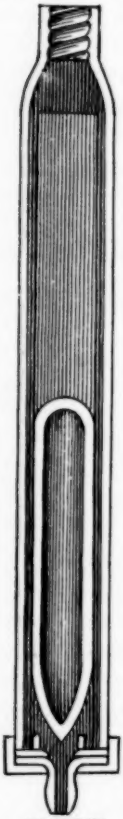
material, weighs less than 600 pounds. It could be hauled with a portable engine; and, supplying 4000 gallons per day, would furnish sufficient water for cooking and drinking for a brigade.

A method of filtration has been adopted in many American cities to secure a water supply filtered by natural agents. This is accomplished by means of infiltration galleries sunk in gravel banks alongside of a river or sometimes beneath its bed. The filtering gallery of Lowell, Mass., is a type of such works used to utilize ground water, and filter it by natural agents. This gallery is on the north shore of the Merrimac River, one hundred feet from the water's edge. It is 1300 feet long, 8 feet wide and 8 feet high. The walls have a thickness of three feet, and a height of 5 feet. They are constructed of heavy rubble masonry laid in hydraulic cement. The walls support a brick arch also laid water tight. Stone braces at the bottom, between the walls, keep them in position. The water received in this and similar galleries does not come from the river, but from the great body of underground water which in general movement is flowing towards the river as an outlet. The filter gallery gives fairly good results; but it has objections. There is no opportunity for cleaning; the gallery is simply a large well with a long horizontal axis. Sometimes difficulty with the gallery results from silting. This occurred in the gallery constructed at Florence, Italy. It was found impossible to keep the gallery clear; and it was abandoned.

Household filtration becomes necessary, either because of a failure to filtrate the general water supply, or because this filtration is imperfectly accomplished. For this work, two systems of devices are in use. Tank filters which are permanent, and are built into cisterns or are introduced into the course of the service pipes; and numerous simple devices intended to be attached to faucets. With each system, various materials as filtering agents have been proposed. In addition to sand, porous stone, brick, iron in turnings, vegetable and animal charcoal, sponge, flannel and sawdust have been used. For tank filters, animal charcoal stands in high favor. With charcoal, the filter becomes more than a strainer. A chemical oxidation takes place, because of the great quantity of oxygen contained in fresh charcoal. The organic matters, being brought into contact with

oxygen, are absolutely destroyed. This power of the charcoal only lasts a limited time, for the oxygen finally becomes exhausted. It must then be replaced, or the gravest dangers will result.

Of the many varieties of household filters intended to be attached to faucets the one in most common use is known as the Pasteur. It is very simple in construction and principle. It consists of a cylinder or candle of fine unglazed porcelain enclosed by one of the metal to which it is connected, at top and bottom, by rubber packing. The water enters the outer metal cylinder, and hence into the receiver, leaving all impurities on the surface of the candle. This filter does excellent work; but care must be taken to keep it clean. It ought not to be located where it will be exposed to high temperature. With a temperature of 60 F., the filter will be sterile from 15 to 20 days; with a temperature of 72 F., about 9 days; with 95 F., only about 5 days. If the filter is not cleaned at the proper time, the outer surface of the candle becomes a breeding place of germs which are leached by the water, and carried through the pores of the porcelain in quantities enormously beyond those contained in the unfiltered water. The initial bacteria of the water does not pass through, but they grow through the filter when the development becomes rapid. To clean the filter, it is only necessary to unscrew it from the faucet, remove the candle with the rubber packing, wash thoroughly, and then boil for half an hour. Faucet filters are now sold of such form as to allow them to be reversed without removal from the tap; and the sediment collected quickly carried off with the first rush of water.



PASTEUR HOUSE FILTER.

In some sections, the water available is excessively hard from solution of calcium carbonate. Such water has little cleansing properties. Its effects are shown in the curds that appear on wash basins; and in the troublesome scale that forms on kettles and boilers. This condition is marked throughout

England. Owing to the pollution of the rivers they have been largely abandoned as a water supply and a new source found in springs and deep wells. The geological strata of England is largely chalk and limestone; and the water, obtained from wells bored through this strata, is so hard as to be unfit for use. The method of softening hard water in universal use is known as Clark's method, from its discoverer, the late Thomas Clark of Aberdeen University. It is a method remarkable for its simplicity and small expense. It consists in merely adding lime water to that which needs treatment. At first thought, one might say that to add lime water to water which is already hard because of holding lime in solution would make it still harder. The contrary is true. Pure water will not dissolve calcium carbonate; water containing carbonic acid will make such solution in proportion to the quantity contained. The rain falling through the atmosphere takes up carbonic acid; and, sinking through a porous chalk or calcareous strata, dissolves certain quantities of the mineral. If such water be boiled, the carbonic acid is driven off; and the lime falls as a precipitate. The same result can be obtained by the chemical reaction that comes from the addition of lime water, and at an expense trifling in comparison. The carbonic acid in the water has a strong affinity for the calcium of the lime water, or calcium hydrate; and forms calcium carbonate which is precipitated. At the same time, the calcium carbonate originally in the water, having the carbonic acid withdrawn, at once falls as a precipitate. It is expressed by the chemical equation:

$$Co_2 + Ca\,(Ho)_2 = Ca\,Co_3 + H_2o.$$

Care must be taken not to add too much lime water; for if it is added in excess of the amount needed to withdraw the Co_2, it would itself cause boiler incrustation. Water can thus be softened in small quantities with the simplest appliances. All that is needed is fresh lime. In England, large plants are constructed to soften the supplies of entire cities. When hard water is used for washing, soap must be used in sufficient quantities to neutralize the calcium carbonate, exactly as the lime neutralizes it, before any cleansing power results. One hundred pounds of lime, costing 50 cents will soften as much water as 2000 pounds of soap costing 130 dollars. At Southampton,

England, 2 million gallons of water are softened daily; furnishing the supply for 60,000 inhabitants. One half ton of lime is used in the preparation of the lime water; and, in addition to this added quantity, one and a half tons of lime are taken daily from the water as a precipitate. This precipitate is known as whiting. The water is reduced from 18 degrees of hardness, that is water containing 18 grains of calcium carbonate per gallon, to one of about 5 degrees of hardness; and is then especially adapted for general supply.

From a sanitary standpoint, all methods of purification are lacking in efficiency compared with that of distillation. The expense connected with this method is all that prevents its general adoption. Notwithstanding the great expense, many engineers advocate the use of distilled water for city supplies. Mr. Hill, of the American Society of Civil Engineers, advocates distilled water to be delivered by separate distribution mains for drinking and cooking purposes. He estimates cost, including interest on plant, to be about 1250 dollars per million gallons. This cost is probably sufficient to prevent any general adoption. In the U. S. Navy distilled water is used entirely for drinking purposes; the cost of production being minimized by using steam from the propelling boilers. Freshly distilled water has often a disagreeable taste. This is now obviated largely by use of the Baird condenser. Its essential feature is the introduction of the steam in such a manner as to drag with it constant and regulated currents of air. The water is thus very efficiently aerated during the very act of condensation.

The simplest of all methods of treating water suspected of containing impurities is to boil it. The value of this method is proven by conclusive evidence. Boiling will very largely destroy disease germs, but will not destroy them all.

Many attempts are being made to purify water by means of electricity. In one method, the result of considerable experience, the water is brought into a long raceway with a series of alternate aluminum and zinc plates, the water passing underneath each alternate plate and over every other alternate plate. The electric current produces hydrate of aluminum, from the dissolution of the plates. The result is thus a chemical purification and akin to that of filtration using alum.

Associated with methods of purifying water are efforts to prevent its pollution. Nature disposes of impurities in various ways, among which that of nitrification is the most important. Nitrification results from the action of a bacillus which tears asunder obnoxious nitrogenous organic materials, and converts them into inorganic forms valuable as plant food. This germ finds facility for development in the upper layers of the soil. To prevent pollution of water from sewage, many cities have established sewer farms. One of the largest in the world is at Asinères, near Paris. The sewage of the city is conducted through the irrigated districts in open conduits above the surface. Side gates at intervals admit the sewage to the furrows between rows of growing plants. The soil is thoroughly worked with the spade, and filtration is intermittent, allowing nitrification proper opportunity for development. At the base of the irrigated district is a sparkling stream consisting of the underdrainage of the farm. It is full of trout, and the water is pure.

Troops in campaign are frequently confronted with the sickness attendant upon the use of poor water. Soldiers who are accustomed to pure water of elevated districts succumb easily to the effects of the water of swampy sections. If an American army were to make a campaign in Cuba, for instance, and the soldiers allowed to drink the natural water of that island, it would require no scientist to predict that the result would be greater loss of life from disease than from the bullets of any foe.

How can impure water be treated for soldiers in the field? Suitably constructed boilers can be carried and the water boiled; the smaller mechanical filters are available, and the drinking water might be filtered under pressure. At hospitals and depots, plants could be established and condensed water be used. Professor Crookes recommended that the very poor water met by the British army on the Gold Coast be treated with a mixture of

1 part permanganate of lime.
10 parts sulphate of alumina.
30 parts of pure clay.

Good results were obtained; but objection was made that the action was too slow.

The "American Water Works Association" has recently memorialized Congress asking for a national law to restrict the

pollution of streams from which water supplies for household consumption are drawn. The memorial is filled with startling assertions. It declares that impure water is responsible for epidemics of Asiatic cholera that has cost the old world more human lives than all the wars from the siege of Jerusalem to the siege of Paris; that 100,000 lives are lost annually in the United States by death resulting from preventable diseases caused by the use of polluted water; that these diseases are spread and sustained in virulence by carelessly and selfishly sewering excremental matter into the ground water courses, streams and lakes.

The memorial earnestly requests that national laws be passed to prevent the pollution of streams from which water supplies are drawn, to the end that the people may be saved from oppressive burdens and sorrows, and the nation from enormous loss.

NOTE.

The author acknowledges assistance in the preparation of this article from the following valuable works:

"Water Supply," by William Ripley Nichols, Professor of the Massachusetts Institute of Technology.

"Handbook of Hygiene and Sanitary Science," by George Wilson, M. A., London.

Report of the Supervising Surgeon General Marine Hospital Service of the U. S. 1896.

"Water Softening and Scientific Filtration," by Walter George Atkins.

"Water Supply," by William P. Mason, Professor of Chemistry, Rensselaer Polytechnic Institute.

"L'Eau," par Gaston Tissandier.

LIGHT ARTILLERY: ITS USE AND MISUSE.*

By Lieut. Col. TULLY McCREA, 5th U. S. Artillery.

AT the outbreak of the Rebellion the light artillery of the army consisted of eight light batteries, two to each of the four regiments. Of these eight batteries, two were serving in Texas and were amongst the troops which refused to surrender when General Twiggs endeavored to turn his command over to the Confederate authorities, and were a part of the troops brought out by Capt. B. H. Hill of the 1st Artillery. But the men and guns only were brought out, the horses being necessarily left behind. So there were but six light batteries available for instant service. To these was added the battery at West Point kept for the instruction of the cadets. This was horsed with the cadet horses, manned from the artillery and cavalry detachments, and officered from the officers on duty at the time at the Academy. This battery was the nucleus upon which the 5th Artillery was afterwards built.

The development of the system of the organization and management of the artillery was essentially the same in each of the armies, and will be best understood by considering that of one of them separately. As the Army of the Potomac was the largest, the most compact and symmetrical in its various parts, and as it is the one I served in and am the most familiar with it is selected by way of illustration.

At the commencement of its organization by General McClellan soon after the battle of Bull Run, its artillery consisted of nine imperfectly equipped batteries of thirty-nine guns. Every arsenal in the North was ransacked, and every piece of whatever character, was placed in the hands of troops then taking the field. Many batteries were mixed as to their armament; some had two, and oftener three kinds of pieces. You can

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readily imagine the confusion and vexation in the supply of ammunition and material of various kinds.

At the outbreak of the war there were no rifle guns in the service, but in the winter of 1860-61 Parrott began the manufacture of his guns. These were followed, soon after, by the 3-inch rifle, known at the time as the Ordnance gun. In addition to these, there were in the Army of the Potomac a few batteries of 20-pdr. Parrotts, which was a mongrel between a field-gun and a siege piece.

By the spring of 1862, when the army started on the Peninsular Campaign, its light artillery had been expanded into 92 batteries, of which 30 were Regulars. These batteries were assigned to the infantry divisions; one Regular and two volunteer to a division. The Regular batteries were designed as an object lesson to the volunteers. The Regular officers thus set up as models were particularly fitted for their work.

The Mexican War was only fifteen years before, and many of them had seen war service and were familiar with the requirements of campaigning, and nearly all had served tours with light batteries. It was my good fortune to have my first service with one of the old light batteries, and one commanded so long by John B. Magruder, and it was a model battery indeed. It may be that my youthful impressions are the most lasting, but in all my service since I have never seen a battery or company which compared with that one in drill, discipline and *esprit de corps*. Although thirty-four years have passed, I can recall the names of the sergeants of that battery, a thing I cannot do for any other organization I have ever served with. These sergeants were of the knock-down and drag-out kind, and an order from one of them met with prompt and unquestioning obedience. I do not pretend to say that this kind of discipline in vogue in those days is the best, but I do say that it had its advantages.

But this state of affairs was soon changed by these seasoned officers and non-commissioned officers accepting commissions of higher rank in the volunteer service.

Right here I might mention that the foot batteries at that time were peculiarly fitted for immediate conversion into light artillery, a condition that does not exist to-day. Before the war, and until within a few years, every artillery post was furnished

with from two to six field pieces, and every battery was drilled in the nomenclature, the manual of the piece, and such manœuvres as were practicable without horses. When these batteries were mounted the principal things they had to learn was how to cut fuses, serve ammunition, and the care of horses. Our reformers have, I think, in this respect reformed too much, and the foot batteries would have to be taught light artillery from the A B C.

This organization of the artillery with one Regular battery in each division as a model, left its stamp on the artillery of the Army of the Potomac through to the end, and made it always superior, battery to battery, to that of the Army of Northern Virginia. In time, the Regular batteries became depleted as to officers and men, and had to be doubled up, so that at the end of the war there was scarcely a battery that was not designated by two letters, as Battery "A and B," 2d Artillery.

In addition to the batteries assigned to the infantry divisions, an Artillery Reserve was organized, consisting of eighteen batteries. Of these, four batteries were horse artillery, but, after the Peninsula Campaign, when the cavalry was organized into a corps, these batteries were assigned to it.

Now let us see how all this artillery was used and misused by the officers commanding the infantry divisions.

The old system, that of attaching batteries to small organizations of infantry, belonging to the epoch of flint-locks and smooth-bores, had outlived its usefulness. The smooth-bore musket had given place to the rifle, while the efficiency of the artillery had advanced in equal ratio. The new conditions affecting the use of artillery was that it should have freedom of action and ability to take positions where full advantage could be had from the improved arm, and this could not obtain so long as the batteries were tied down to the infantry; so long as they were portioned out at regular intervals, along the line of battle, without regard to the topographical features of the field. Artillery should occupy the positions, afforded on every battle-field, where it can reach the enemy to the best advantage with its fire. Position is the chief factor, and its importance increases in compound ratio with the range, accuracy and power of the arm.

In the Army of the Tennessee batteries were attached to divisions, as in the Army of the Potomac; but there was no artillery reserve, nothing to draw upon in case of disaster, as in the battle of Shiloh, for instance. In the Army of the Cumberland it was worse still, for the batteries were attached one to each brigade, and this army too was without a reserve. The battles of Chickamauga and Stone River show the folly of this arrangement.

At the battle of Williamsburgh, Hooker placed his battery in a quagmire, amongst fallen trees and stumps, and when his infantry was driven back, the artillery carriages were hopelessly stuck in the mud and had to be abandoned. Hancock, in the same battle, placed his batteries with more judgment, and they, by the rapidity and precision of their fire, drove the enemy from their portion of the field.

At the battle of Gaines' Mills, Sykes divided Edwards' battery and sent two guns with each brigade. Morell divided some of his batteries in the same way and posted two batteries on his extreme left, with little or no support, where, from the nature of the ground, they had but little scope for their own defense, and fell an easy prey to the enemy.

All four of these last-mentioned division commanders were graduates of the Academy, but none belonged to the artillery, and none had made a special study of its proper use. Their idea seemed to be that the batteries should always be brought into action, no matter if the ground was, or was not, suitable; no matter if the batteries were placed in a trap, from which they could not escape if the supporting infantry gave way. I recognize the fact that there are occasions when it is necessary to sacrifice a part of a command for the good of the whole, but it should not be done unless it is certain that good is going to accrue from the sacrifice. The battle of Antietam presents an example: two batteries were sent into action where it was thought by the officer sending them in that they would be captured. But it was necessary to hold the enemy in check, and gain time for the reinforcements, known to be near at hand.

At the battle of Malvern Hill, the artillery was posted along the line in the usual way, and had succeeded in repulsing several assaults upon our lines, but just at sunset the enemy made

his last and most determined assault upon the portion of the line held by Fitz-John Porter, At this critical portion of the battle, General Hunt pushed forward the batteries of the artillery reserve, forming a continuous battery of sixty guns, which, when it opened upon the enemy, crushed him back into the woods, from which he did not return. This is the most marked instance during the war, of the power and effect of artillery, brought in mass against an enemy at the crisis of a battle. At Shiloh, fragments of batteries were assembled and formed a cordon of guns behind which the Army of the Tennessee sought shelter and awaited reinforcements. At Stone River, the batteries having, through disaster to the infantry, become shaken loose from the brigades to which they were attached, were gathered together and saved the Army of the Cumberland from further disaster. But, in no instance, were they brought up in mass, as at Malvern Hill, to snatch victory from defeat.

At the battle of Antietam, Sedgwick's division having driven the enemy across the Sharpsburgh pike, were met by a new line, which arose from behind a stone wall, and poured in a volley it could not stand, and it broke and became in its turn the pursued. There was nothing in the way of reinforcements, on this part of the field but two batteries of light twelves, which were posted a short distance behind the line of battle. These batteries were ordered to the front, and went into action at a gallop, the only instance that came under my observation where a battery was required to go out of a walk. In going to the front, the ground was such that it was necessary to form column of sections. The command in the field was "Right front into battery." The first section was formed into battery two hundred yards in front of the advancing enemy and immediately opened with canister. The other sections formed successively to the right and commenced firing until the twelve guns were in a continuous battery. This battery drove the enemy back and held the position until relieved by Franklin's division. But the Chief of Artillery of the 2d Corps at the battle was Major Clark, of the 2d Artillery, a veteran of the Mexican War, who was quick to see his opportunity, and fortunately the captains of the batteries were equal to the occasion.

This is a fine example of the proper use of artillery, and this

same battle furnishes an equally fine example of its misuse. Richardson's division was annoyed by one of the rifle batteries of the enemy, and a 12-pdr. battery was ordered up on his line to silence it. Any artillery officer would have seen that the enemy's battery was beyond the range of smooth-bore guns, and that he was subjecting the 12-pdr. battery to a duel which was hopeless. But this battery was the only one available, and it was kept in this position until it was so disabled that it was of no further use until it had an opportunity to refit.

At Fredericksburg the artillery played a minor part, being engaged principally in covering the crossing of the infantry divisions. Several batteries of the Right-Grand division were placed in front of Marye's Heights where they could do no possible good, and were smashed by the rebel batteries which had a plunging fire, and which, in turn, could not be reached, as they were elevated and were covered by intrenchments.

After Fredericksburg, the Army of the Potomac was reorganized to a certain extent. The grand divisions were abolished, and a great deal of the discordant element amongst the general officers, which had been the bane of the army from its organization, was gotten rid of. But the organization of the artillery remained as before, *i. e.*, the batteries, except those of the artillery reserve, remained assigned to the infantry divisions. The artillery reserve was reduced to twelve batteries, and its efficient commander, Col. Hayes, received the well-deserved promotion to a brigadier general, but he was assigned to an infantry command. The reserve was now commanded by a captain. General Hunt says, in his report of the Chancellorsville campaign: "It will perhaps, hardly be believed that for the command and management of the artillery of the army, consisting of 412 guns, 980 artillery carriages, 9543 officers and men, 8544 horses, besides their large ammunition trains, there were but five field officers of artillery in the army."

As a preliminary to this unfortunate campaign, Hooker had deprived his faithful and skillful and efficient chief of artillery, General Hunt, of all except administrative control, and had placed no one in actual command. The artillery, at Chancellorsville, was literally without a head, and it was too, on a field, which on account of its topographical features preëminently de-

manded a head. There was no one whose special business it was to look for eligible positions for batteries, and having found them, with authority to place them there, and command them when posted; to select rifles for positions requiring such pieces, and smooth-bores for positions adapted to their kind.

Hooker had upon this field about two hundred guns, scattered, as usual, amongst the infantry divisions. It was not until disaster had befallen the army that Hooker recalled his chief of artillery, and invested him with authority to restore order. If what was then done as a restorative, had previously been done as a preventive, the probabilities are that Chancellorsville would have had another and a very different history.

It will be remembered by the student of this battle that when Stonewall Jackson was passing in front of the army to reach the right flank, there was a point called "the furnace" where his column was plainly visible, and Sickles was sent with two divisions and a brigade to find out the nature of the movement. Although he had forty-two regiments, strange to say he did not take with him a single piece of artillery. His batteries were left at an open space called "Hazel Grove," where they were afterwards joined by a horse battery. It was these batteries which *happened* to be together, and fortunately in the right place, that were such an important factor in checking Jackson's triumphant career when he struck and smashed the 11th Corps, and doubled up our right flank. It was the unexpected effect of this artillery fire that staggered and arrested the enemy. Nothing but the timely and gallant conduct of these batteries prevented the enemy from gaining the flank and rear of the 12th Corps, as they had that of the 11th. These batteries happened to be in the right place, but were not placed there by forethought or design, and fortunately the senior officer, Captain Huntington, of the 1st Regiment Ohio Artillery, was equal to the occasion. Fortunately also, another capable artillery officer, Captain Best, of the 4th Artillery, concentrated thirty-four guns in a favorable position, and did much to retrieve the disaster that was threatening the Army of the Potomac. It was of this battery that A. P. Hill said in his report 'the enemy concentrated a terrific fire upon the head of my division."

Jeb. Stuart, who succeeded Jackson, was busy during the night of the 2d putting his command in order to receive the attack at daylight. He says "I sent Colonel Alexander, senior officer of artillery, to select and occupy with artillery positions along the line bearing upon the enemy's position, with which duty he was engaged all night." A strong contrast to what was *not* being done within Hooker's lines. He further says: "As soon as the sun lifted the mist which shrouded the field, it was discovered that the ridge over the extreme right was a fine position for the concentration of artillery, I immediately ordered thirty pieces to that point, and under the happy effect of the battalion system, it was quickly done. The effect of this fire upon the enemy was superb." The battalion system, so thankfully mentioned, was the great distinguishing difference in the organization of the artillery of the two armies. It was a system of concentration and efficiency, in contradistinction to that of dispersion; and furthermore it relieved division and brigade commanders from the necessity of having their attention called from their own appropriate duties to attend to artillery matters.

The next day, when the army had formed a new line, General Meade ordered his Chief of Artillery, Captain Weed, to collect all the batteries he could find, and place them in a salient in our line about three-quarters of a mile in rear of the Chancellor's house. On the right face Weed placed 28 guns, on the other 24, with 4 in the angle. During that and the following day the enemy made demonstrations on this position but no formidable attack. The battery to which I belonged was on the right face and I remember that we were longing that he should attack. From a professional point of view it is to be regretted that he did not.

Weed's services on this occasion were rewarded by his promotion to a brigadier general, not however to command artillery, for which he had proved himself so well qualified, but to command an infantry brigade, with which he had no previous experience. Of the twenty-eight officers of artillery who were made general officers, only Barry, Hunt and for a time Brannan, were on artillery duty; all the rest were assigned to infantry commands.

The Federal batteries, after the first year, were armed and

equipped to perfection, and fairly instructed also, but here all that was good about the organization ended. The brilliant services of the batteries were due to their own excellent qualities, and were in spite of the method of using them.

After the disastrous campaign of Chancellorsville the defect of the system was so manifest that Hooker was willing to listen to the suggestions and advice of General Hunt, and consented that the artillery should be formed into brigades of batteries, which corresponded to the battalions of batteries in the army of Lee. One brigade was assigned to each army corps, two brigades to the cavalry, and four to the artillery reserve, each to have its own commander, who received his orders direct from the corps commander. This did away with the divisional artillery, and was a long step in the right direction, but there were few officers of the proper rank to command these brigades. The brigade to which I belonged was commanded by a captain of a volunteer battery, both Regular batteries being commanded by lieutenants.

General Hunt in his report on Gettysburg says: "In this campaign, for the command of 67 batteries (372 guns) with over 8000 men, 7000 horses, and all the material and large ammunition trains, I had but one general officer commanding the reserve, and but four field officers; two colonels, one lieut.-colonel and one major." The most of these commands in any other army would have been considered proper ones for a general officer. In no army is the artillery of a corps considered of less importance, to say the least, than that of a brigade of infantry. Not only does the service suffer, necessarily, from the great deficiency of the officers of rank, but the policy which closes the door of promotion to battery officers, and places them and the arm itself under a ban, has caused many of our best officers to seek positions wherever they can find them, which will remove them from this branch of the service.

Gettysburg was the first battle of the Army of the Potomac in which the artillery was, as a whole, brought to the front, a fact due to the more efficient organization which it had just received. If the same thing had occurred at some of the other battles, it is more than probable that history would have had a different story to record. One of the main features of this battle

was the grouping of the batteries, thus giving to their fire the effect of concentration and mass. Gettysburg has been discussed from every point of view except that of artillery, yet every account of the battle refers to the effectiveness of the arm. Scarcely any of them omit to mention the distinguished part which it performed, but how this was brought about, and wherein the management of the batteries in this battle differed from that of Chancellorsville or other preceding battles, has been passed by as a mere tactical or administrative detail, overshadowed by the magnitude of the conflict as a whole. The artillery of the Army of the Potomac had, at last, received the same efficient organization so long in use in Lee's army, and in this battle the whole of the artillery in both armies was fought for all it was worth and fully illustrated the power and influence in battle of the arm when properly managed.

The battle was commenced by General Buford on July 1st, with his division of cavalry and horse battery "A" 2d Artillery. His object was to delay the advance of the enemy until General Reynolds with the 1st and 11th Corps could reach the field, and General Meade could gain time to concentrate the Army of the Potomac, which was necessarily scattered, to cover Washington and Baltimore. General Buford says in his report: "Tidball's battery, commanded by Lieutenant Calef, fought on this occasion as seldom witnessed. At one time the enemy had a concentrated fire upon this battery from twelve guns, all at short range. Calef held his own gloriously, and worked his guns deliberately, with great judgment and skill. Reynolds' divisions arrived successively on the field, and about an hour afterwards the 11th Corps. The batteries of these corps were put into action as they arrived, were all roughly handled by the enemy and had finally to retire to Cemetery Hill. Half of Lee's army was engaged against two-sevenths of that of Meade, and the odds were too great. The contest of this day would have been considered a great battle in itself had it not been for the overshadowing magnitude of the two succeeding days. It enabled us to seize Cemetery Hill and the ridge of Round Top. The advantage of this position was decisive of the battle and the campaign. General Meade determined to give battle at Gettysburg and early in the evening of the 1st gave orders for all the

corps to concentrate there, directing all independent trains to be sent back to Westminster. Strange to say, two batteries of 4.5-in. rifles were sent back, and thus the valuable services of these long range guns were lost upon a field singularly adapted to their use.

Early in the morning of the 2d General Hunt examined the field respecting the arrangement of the artillery for the coming battle. Commencing on the extreme right of our line four batteries of the 12th Corps were in support of the infantry on Culp's Hill, but not in position. On Cemetery Hill he found the batteries of the 1st and 11th Corps under Colonel Osborn. Still further to strengthen this position he ordered five additional batteries from the artillery reserve, making a battery of 46 pieces, 6 20-pdr. Parrotts, 22 light rifles, and 18 Napoleons. The eight long range rifles, sent back to Westminster, contrary to the advice of the Chief of Artillery, would have been invaluable in this position. The guns upon this hill compelled the enemy's infantry to make a long detour in reinforcing one wing from the other. The five batteries of the 2d Corps were in the line of battle on Cemetery Ridge. None of the other corps had yet taken position in the line, but their batteries were in hand in readiness for it, except those of the 6th Corps. Sickles' mistake in advancing his corps to the faulty position on the Emmittsburg road brought on the battle in the peach orchard and came near being disastrous. General Hunt, as soon as he reached the locality, saw the weakness of the position, and ordered up McGilvray's brigade of five batteries, and then Ransom's brigade of three Regular batteries, until he had in position eighty pieces, fifty of which were from the artillery reserve. The ground was unfavorable for artillery, being exposed to a flank fire from the enemy's batteries posted on Seminary Ridge. The inherent weakness of the peach orchard position was such that no amount of fighting could have held it against the force General Lee brought against it, and the line was broken and driven back to Cemetery Ridge, where it should have been originally. It was while this contest was going on that Longstreet sent Law's brigade of Hood's division to seize Little Round Top which we had failed to secure. General Warren, Chief Engineer of the army, having ascended Little Round Top

for observation, saw the long line of infantry approaching, and knowing the vital importance of the hill, secured the first troops he could reach, which were Vincent's brigade and Hazlitt's battery of the 5th Corps. Hazlitt's guns were dragged by hand, with great labor, through rocks and bushes, to the crest of the hill, from which position they opened a fire represented by the enemy to be exceedingly damaging to them, taking them, as it did, in the flank. The assailants were finally driven back with a percentage of loss seldom witnessed in a battle. This was the famous fight of the Devil's Den. It was here that Weed and Hazlitt of the 5th Artillery, and O'Rorke of the Engineers, who commanded a New York regiment were killed, and Watson of the 5th Artillery lost a leg.

The night of the 2d was devoted to repairing damages, replenishing ammunition chests, and reducing and reorganizing such batteries as had lost so many men and horses as to be unable to work efficiently the full number of guns. Batteries too much disabled were withdrawn and replaced by others from the reserve. The question of artillery ammunition was now giving General Hunt and others great concern. The management of the artillery trains was not yet under the control of the artillery and many of them had been sent back as impedimenta to Westminster. The ammunition train of the artillery reserve so frequently before called upon to supply deficiencies arising from similar causes, had already been drawn upon until the supply was becoming alarmingly low. All artillery commanders were therefore cautioned to be economical in the use of it.

The morning of the 3d found the artillery disposed as follows:—Muhlenberg, Chief of Artillery of the 12th Corps, had 20 pieces ready to assist his corps in ousting the enemy from its position on Culp's Hill, which it had secured the night before. Wainwright, of the 1st Corps, had 24 pieces on Cemetery Hill, to the right of Cemetery Gate. Osborne of the 11th Corps had 46 pieces to the left of the gate. Hazzard of the 2d Corps had 38 pieces on that part of Cemetery Ridge occupied by his corps. On the left of these McGilvray had 40 pieces of the artillery reserve, and to the left of these were the batteries of the 3d, 5th, and 6th Corps, while 12 pieces crowned Round Top; making altogether 200 guns in position along the line. All surplus

batteries were with the artillery reserve, which was at a central point behind Cemetery Ridge, in readiness to render assistance to any point endangered.

General Lee, the previous day, had attacked the right of our position, then the left, and had failed in each. He now determined to make a concentrated attack on the centre, the position held by the 2d Corps. In execution of this project the batteries of Longstreet and Hill were posted in the edge of the woods along Seminary Ridge in such a manner as to have a converging fire on that part of the line to be assaulted. The assaulting column was composed of Pickett's division, supported by Andrews' and Pettigrew's, and two brigades from Pinder's division, in all 18,000 men. This mass of men was moved in three lines nearly a mile over open ground, exposed the whole time to a direct, cross and enfilading fire of the 200 Federal guns previously mentioned, and finally to the musketry of the infantry.

General Pendleton, in his report says:—"About 1 P. M. our guns in position, nearly 150, opened fire along the whole line right to left, salvos by battery being much practiced to secure greater deliberation and power. The enemy replied with their full force. So mighty an artillery contest has perhaps never been waged, estimating together the number and character of the guns, and the duration of the conflict. The average distance was about 1400 yards, and the effect was necessarily serious on both sides. With the enemy there was the advantage of elevation, but his fire was divergent, while ours was convergent."

General Hancock in his report says:—"About one o'clock the enemy opened fire upon our front with the heaviest artillery fire I have ever known. Their guns were at an average distance of 1400 yards from my line, estimated at 150. The air was filled with projectiles, there being scarcely an instant but that several were bursting at once. The batteries of the 2d Corps, consisting of 'I' of the 1st, 'H' of the 4th, Arnold and Brown, Rhode Island, and Rorty's New York batteries had the brunt of his concentrated fire. Three battery commanders, Woodruff, Cushing and Rorty, were killed and in the two Regular batteries but two officers of the six were uninjured."

These batteries fought as batteries seldom have fought, and so much were they cut up that after the engagement, the five batteries were consolidated into three.

The fire of the enemy's artillery continued two hours, the official reports say, but it seemed an age to those who were subjected to it. As soon as it ceased the assaulting column marched from the woods on Seminary Ridge and were prepared for the perilous work before them. Think for a moment what a target for artillery this was: 18,000 men in three long lines. Compare 18,000 men with the 500 we have at one of our reviews, and you may form some conception of what a mass it was. There was no need to bracket the target, for it was the third day of the fight and we had the range perfectly.

We have all heard of the heroism and valor of the charge of the Light Brigade at Balaklava. Tennyson has made it famous, and the British point to it with pride to this day. But the charge of the Light Brigade was the rash act of an angry man, and that one man only knew, when it started for what it was destined, they went into it as fast as their horses could carry them, and it was all over in a few minutes. Not so with Pickett's men. They knew for hours before what they had to do, and they came across that field with a nerve that has never been equalled, and a courage that has been the admiration of the world ever since.

Like the Light Brigade at Balaklava they too had cannon to the right of them, cannon to the left of them, and cannon to the front of them, and it was these same cannon that proved their undoing.

Every rifle from Cemetery Hill to Round Top opened on them as soon as they appeared, and the smooth-bores as soon as they were within range. In spite of all they came across that 1400 yards and pierced our line, but the artillery fire had reduced their numbers and broken their formation to such an extent that they were too weak to be effective, and they were all killed or captured.

Like Shiloh, Malvern Hill, and Stone River, the artillery had again saved the day.

A short time after Gettysburg, a rebel sympathizer spoke to Mr. Adams, our Minister in London, in a boastful way of this

charge of Pickett's; Mr. Adams replied to him "Yes, that was a gallant charge; those men are my countrymen, and I am proud of them."

Now that thirty-four years have passed, a new generation has succeeded the one that furnished those men, and the animosities of those days have disappeared, let us hope forever, we can all be proud that the men who made up Pickett's division, and the divisions which beat it, were our countrymen. If other countries want to try conclusions with our own, they will have to reckon with just such men, who instead of expending their valor in trying to overwhelm each other, will be found shoulder to shoulder fighting in a common cause. The combination I undertake to say will be found irresistible.

IMPROVEMENTS IN APPARATUS FOR SIGNALLING.

By Major HOWARD A. GIDDINGS, Brigade Signal Officer, Connecticut National Guard.

IT is perhaps remarkable that practically no change has been made in the original and primary outfit for military signalling, the flag kit, since the genius of Myer first introduced the system in the armies of the United States. We have retained the same sizes of flags, the same method of attaching them, and the same crude and unsatisfactory staff joint. Moreover no increase in the effective range of flag signals has been achieved, as our telescopes and glasses to-day are practically no more powerful than those used in the War of the Rebellion.

It is no less remarkable that a newer device for signalling, the heliograph, has to the present time remained in a form involving a complicated, inaccurate and uncertain method of sighting and adjustment.

Several improvements which have been recently made in signal equipment are deemed of sufficient importance to here bring to attention.

A marked improvement to the service heliograph has been devised by First Lieutenant William F. M. Rogers, Signal Corps, Connecticut National Guard. The device consists of an

auxiliary bar,—the counterpart of the tangent-screw end of the main bar,—which carries the sun mirror. The auxiliary bar is attached to the screw of the tripod head, above the main bar, the screw being made slightly longer for the purpose. Both mirrors carry a disk over the unsilvered spot, that of the sun mirror being fixed, and that of the station mirror being carried on a movable arm about the shape and size of a knitting needle.

In using the heliograph with this device the instrument is sighted as when only one mirror is used, by looking through the station mirror from the back, and sighting over the sighting rod. The auxiliary bar is then attached on the side of the main bar opposite the sun, swung forward as far as possible without the mirror cutting off any of the flash from the station mirror, and clamped. The disk of the station mirror is adjusted over the unsilvered spot, the full flash from the sun mirror is thrown on the station mirror, and the shadow spot adjusted in centre of the disk ; the shadow spot from the disk of the station mirror then being adjusted on the disk of the sighting rod the flash is visible at the distant station. Adjustment is kept by keeping the shadow spot from sun mirror on the disk of the station mirror.

The advantage of this device, which adds less than a pound to the weight of the heliograph, will be at once appreciated by all signallists. The difficulty and uncertainty of sighting the heliograph with two mirrors, in the old way, when no prominent point in the distant horizon line appeared, to locate the station in the reflection in the mirror, the lack of a reference point by which to guide the flash when sweeping it about in search of a station, the impossibility of sweeping it in a horizontal plane, the difficulty of securing exact adjustment, and the complications of the method to the inexperienced signallist, vastly outweigh the objection to a slight increase in the weight.

Briefly, the advantages of the device are as follows : The instrument is always sighted in the same way whether one or two mirrors be used, and by a direct sight, similar to sighting a gun. If after signalling with one mirror it becomes necessary to use two, it is not necessary to reset the instrument, but simply to clamp on the auxiliary bar, adjust the flash and proceed with the signalling. The main bar always lies in the plane of the

line of vision, facilitating adjustment of the flash by compass. The flash may be swept in a horizontal plane by turning the station mirror, the sighting rod constituting a guide to position of flash.

An instrument of this pattern has been used by the writer, over a twenty mile range, with perfect success, all the signallists present being impressed with the simple and accurate adjustment of the flash. It is found that the *shadow spot from the movable disk is much more sharply defined* on the disk of the sighting rod than a shadow spot from the unsilvered spot of the mirror, and the *disk is preferably kept over the unsilvered spot when using only one mirror.*

Another improvement to the service heliograph is the substitution of a pinion and gear wheel, for the tangent worm gear method of revolving the mirror about its horizontal axis. By the old method it was necessary to slowly screw the mirror back into its normal position in the frame before placing in the box. The new method not only allows of a very quick and fine adjustment, but permits the forcing of the mirror into its normal position, by hand, without damage to the mechanism. The simplicity and advantages of this device from a mechanical standpoint are apparent.

Various other minor improvements are noted in the latest heliographs. The lost motion when reversing the tangent screw on the mirror bar seems to have been overcome, and some parts have been strengthened without increasing the weight.

It should be borne in mind by the manufacturers of these instruments that while improvements looking to the finer adjustment, simplicity, etc., are most desirable, no changes should be made involving a sacrifice of interchangeability. Some instruments recently examined have no unsilvered spot on the sun mirror; others will not fit the sockets in the bars now in service, and in another style of instrument the heads of the tripods are different, so that the heliograph tripod cannot be used for the screen, and *vice versa.* Such things result in great annoyance and possible disaster, in service.

All tripod heads should be of one kind, interchangeable, and with a uniform screw-thread. All mirrors should fit the sockets of any mirror bar, and should have unsilvered spots,

in order that they may be used either as sun or station mirrors.

The general use of the bicycle for transporting signallists and apparatus, has necessitated a different style of tripod for the heliograph, as the service tripods in skeleton case present too great a diameter to be carried on the modern narrow-tread bicycle, in the only practicable place,—along the upper bar of frame, between the legs of the rider. In a tripod devised by the writer, which overcomes this difficulty, the legs are one inch square, and are detachable from the head. In packing for transportation, the legs of both tripods are unscrewed, stacked one on the other, and a skeleton leather case slipped over the ends and strapped. Pockets on the side of each leather end contain the tripod heads. The bundle thus formed is six inches deep and one inch thick, and may be carried on the cycle with less inconvenience than a rifle.

At last the ferrule joint for signal flag-staffs, always either annoyingly loose or exasperatingly tight, has been supplanted by a joint, strong, secure and easily adjusted. It consists of easily fitting ferrules with a short screw at the joint. The end of the smaller length of staff slides easily into the larger ferrule until the screw is reached, when the parts are screwed together, securely and strongly locking the joint.

Signal flags recently sent the writer for examination are fitted with alternate ties and loops for sliding over the staff, an admirable device, which not only holds the flag in place while attaching, but saves half the time and labor of tying. Many signal flags however seem to be made with a primary view to durability. While it is admitted that good wearing qualities are desirable, it is hardly permissible to make them of the same material as storm signal flags. On the contrary they should be made of very thin, tightly woven, soft, smooth and light material. The finer quality of cambric is probably the best cloth for the purpose.

In the matter of improvement in apparatus for signalling there is great room for the display of inventive genius. The urgent need to-day is for some feasible method of transmitting field signals without wires, over distances approximating the range of the heliograph, upon cloudy or stormy days, and at night.

May American genius soon bring forward such a device.

SOME IMPRESSIONS OF THE GERMAN MANŒUVRES OF 1897.

By First Lieut. FREDERICK S. FOLTZ, 1st U. S. Cavalry.

AT half past five on the morning of September 6th, last, a group of some thirty of us were assembled in a waiting room of the handsome railway station of Frankfort-on-the-Main, to receive, from an officer of the German General Staff, the general and special ideas of the manœuvres which had begun at midnight.

Our group was composed of about a dozen officers in civilian's dress (six Americans, three Englishmen, a Swiss, a Dane). We all had, through the courtesy of the Government, special permission to see the manœuvres and were supplied daily with maps and extracts of the orders.

From the printed orders and maps furnished us, we learned, while swallowing a hasty breakfast, that a "western army" (the enemy) had in the first days of September crossed the Rhine at Coblentz and below, and was advancing eastward, towards the eastern army (the Germans) which was hastily concentrating behind the line of the Wesser and Werra and in the Vogelberg hills.

An "army division" of the enemy, two army corps and a cavalry division, had crossed the Rhine at Coblentz and were to protect the right flank of the main army.

Opposed to this detachment the Germans were moving up two army corps from Bavaria, and a cavalry division was keeping connection between this force and the main army.

A map of the theatre of operations showed very indefinitely where the various divisions were known, by their enemies, to have been on the evening of the 5th.

Another map on a very much larger scale gave every detail of the ground which was to be the actual scene of manœuvring.

This General Staff map does not strike me as being all it should be. The hachure system is not equal to that of contours, and I used on the field, in preference to this, a bicycle map with contours in brown. The detail of the official map is marvel-

lously exact, extending even to the location of single trees where they occupy a prominent position, but through the use of only one color (black) the value of the details is lost in the resulting confusion.

Before going on the field with such a map, the streams should be gone over with blue and the figures indicating altitudes should be underlined in red.

The "order of battle" showed about 60,000 Prussians representing the invaders, composed of 72 battalions of infantry, 55 squadrons of cavalry and 57 batteries of artillery; about 44,000 infantry, 7000 calvary and 286 guns.

This force was composed of the VIII. and XI. Army Corps and a cavalry division.

There were three divisions to each corps, the division being composed of two brigades of infantry, a regiment of cavalry, and six batteries of artillery; the Corps Artillery besides this numbering about 10 batteries.

The cavalry division consisted of 3 brigades of 2 regiments each, and of two horse batteries.

Infantry brigades consisted of 2 regiments each 1800 men, three battalions of four companies of 150 rifles.

The cavalry regiment was formed of 5 squadrons of 125 men.

The batteries had usually six guns, some only four.

Before we had gotten more than a general idea of the situation, we had to run for the train with a sandwich in our pockets, and were on our way to Hanau, 15 miles east of Frankfort, near where we expected that the cavalry screens of the opposing armies would meet. The rain had been falling in torrents all night, and there was but a gloomy prospect through the rain splashed car windows, when, halfway to Hanau, we found ourselves in the midst of heavy artillery firing.

Some of the correspondents bundled off here and had the satisfaction of seeing a Bavarian battery, which had ventured too far in this advance guard combat, surprised and captured by the Prussians. "That poor fellow," said one of the correspondents, alluding to the captain of the battery, "will be in New York next winter; he will get a polite note informing him that the Emperor will be graciously pleased to dispense with his further services."

At Hanau all was motion. Bicyclists covered with mud were doing what they could to keep their sorry looking wheels in working order. The court of the station seemed to be temporarily the headquarters of one of the Bavarian corps. A dozen Uhlans sat on their steaming horses wet to their skins. Officers rode up and reported, with the water trickling in a steady stream from the vizors of their helmets down their weather-beaten faces.

We saw no overcoats or rain coats at this place, everyone had apparently gotten wet to the skin at the very first and could only grin and bear it.

In one corner of the station I found several lances, great heavy steel tubes, 10½ feet long and weighing about as much as a duck-gun, some 9 pounds, I should say.

The elements were so unpropitious that we were loath to take the first plunge into the mud and water outside, so, after some delay, we got a carriage and with six inside took the road to the north.

In the meadows to the north of Hanau we found the Bavarians in a continuous line engaged, at about 1000 yards, with a heavy line of Prussians in the edge of the opposite wood.

The Bavarians stood shoulder to shoulder in double rank taking their medicine unflinchingly. We surmised that the umpires had not required them to actually seek cover on account of the muddy condition of the cultivated grounds.

Passing through the line without being asked to show our passes, we soon found ourselves among the darker blue uniforms of the Prussians—holding the southern edge of the wood and well concealed; the brown canvas covered helmets, which distinguished them as the enemy for the time, were a great advantage, as the first intimation of the presence of the Bavarians was usually the shimmer of the helmet spikes and ornaments.

The tin cooking utensils carried on the knapsack are quite as fruitful a source of information but, while the Germans have a new equipment of blackened aluminum to remedy this defect, it is strange that they stick to the brass mounted helmet.

Pushing further on behind the Prussian line we find several field batteries in reserve along the road. They left Homburg at midnight, and after their night march of 15 miles in a driving

cold rain, they look as though manœuvres were a very real thing to them ; their blue coats are so wet that you can see the muscles of the back move under them, the Prussian blue of the cloth has become a black.

Some of the men's faces are white, some are blue with cold, and there is as yet nothing to give a touch of hilarity to the occasion.

The day is too young and the rain seems to have no idea of stopping.

The artillery is still engaged over on the Prussian right, so we want to turn to the west off the highway. Our driver, however, knows too much to leave his perfect macadamized road for the elusive directness of the tracks that lead due west across the fields. On we go to the north ; at Bruchkobel we find the railway embankment held by a Prussian line peering anxiously to the eastward into the driving mist. Here the Prussians are flat on their faces ; they take off their helmets to peer over the rails but never their packed knapsack, with its overcoat rolled about its top and sides, though these packs must be very heavy by this time of the day.

Turning now to the west, we come upon some infantry in reserve who ask us whether the troops they can see in the woods we have just come through are their own or the enemy. All but the highest commanders have a very limited horizon on the modern field. Reaching Mittelbuchen we find the Prussian headquarters and we have to leave our carriage as the roads are blocked with marching troops.

Tramping forward through the village with our mackintoshes slashing about our legs and plastering our golf stockings and knickerbockers with mud, we come suddenly upon a tall officer, in a loose gray overcoat, standing with another officer in the middle of the street. We recognize him at once, from his photograph, as General von Haesler. He is gaunt and thin, with a face on which the skin is drawn tight like parchment. He has the reputation of being a man who is not to be caught napping, and last night he set his army in motion as soon as time was called, midnight September 5th and 6th.

We look around for the General's Staff ; there is his headquarter flag and half a dozen mounted orderlies, and farther on

there are three officers studying their maps which are protected by transparent celluloid cases. They look like soldiers; they look lean and hard, and not as though they had had long tours of office duty.

Forgetting all about our determination to keep dry, we yield to the "go" that surrounds us, and falling in as file closers, we trudge along with an infantry column towards Wachenbuchen.

I could not help wishing I could see the difference it would make in the movements of these men, if they could exchange their helmets for campaign hats and their heavy boots for a laced shoe. They manage to do great marching, it is true, but it is in spite of the boot which gives them even on good ground a hulking, dragging gait. It is claimed that the boot has great advantages in a rainy cultivated country in excluding mud, and this may be the secret of its use by Germany and Russia, though Austria and France use the shoe.

The column now leaves the paved road and climbs the gentle slopes of cultivated ground to the north of Wachenbuchen.

On the highways the mud was a gruel that splattered you cheerfully to the waist, but the footing was smooth and firm; in the fields it is terrible going, yellow clay in which the foot slips and sinks to the ankle at every step. The battalions break into companies, and the companies into sections, and each little column of fours struggles along as best as it can. Finally we reach the top of the ridge, some 200 feet above the valley we have left, and find six or more battalions standing in solid squares concealed by small depressions of the ground; two batteries of artillery are also waiting under cover of a small wood; down on the slopes to the southeast sentinels are kneeling on one knee in the sugar beet fields, trying to peer through the falling rain. Some of the men are exchanging their boots for the shoes they carry on their knapsacks. I am only surprised that they are not all doing the same for they, like the artillerymen we spoke to, have marched 15 miles from Homburg since midnight. They say, indeed, that they started half an hour earlier. Old General von Haesler evidently did not propose to be "left at the post."

We have been hearing faint trumpet notes from the southwest; they are gradually taken up until the trumpeters about us are all joining in the chorus. It is the "Great Halt," sounded by the Chief Umpire—the Kaiser in this case; the subordinate umpires now make their rounds rapidly and establish the position of every unit and output line on their maps; the troops when their positions are noted, stack arms and wait for orders.

Some of the officers near whom we found ourselves spoke good English and French, but they were so cold and exhausted that their teeth chattered in trying to speak to us, and the only kindness we could show them was to bid them good day. They were in big bunches so our brandy would not have gone around. As it was now 2 P. M. and as we supposed there would be nothing further of interest, we left the field, only to hear the guns at work again as we took the train for Frankfort.

The Kaiser had sounded the advance again at 3 o'clock; and it was 5 P. M. before the troops reached their billets in the villages, where they were served with a double allowance of strong hot punch made from Schnapps, which doubtless put many a man on his feet. They had not been allowed to wear their overcoats during the day in order that they should have them dry to sleep in; they had also dry underclothes in their knapsacks, but many did not have access to fire and had to put on wet uniforms next day. The effect of this first day, of great exertion, excessive cold, and wet, must have been very injurious; it was said, it is true, that the sick list next day showed only 67 as the result of the exposure.

The men were hardened, to be sure, by the long training which culminates in these manœuvres, but even this did not keep their faces from turning a greenish white nor their teeth from chattering. I think the 67 must have been very sick indeed, and I saw some very sick looking men who must have been considered well, at least until the manœuvres were over. Much to my surprise, I had seen no bodies of cavalry on this first day of contact, and I could not learn of any cavalry combats in other parts of the field. The artillery, on the other hand, had opened the ball and had been close to the front all day.

At 5.30 the next morning, the war correspondents and ourselves again met in the Frankfort station, and received maps indicating the position of each division on the evening of the 6th, and also brief statements of the situation, and extracts of the orders of each side for the day.

Our map showed us that Windecken would be in the centre of an intrenched position, which the Prussian XI. Corps was to hold until it could be reinforced by the rest of the VIII. Corps which was hurrying up to its assistance.

Reaching the ground at 8 A. M. we found the intrenchments dug and strongly manned, the guns in position in gunpits, and the artillery duel well under way. The country was hilly, but the hills were not abrupt, no slopes up which cavalry could not gallop, no fences, no ditches deeper than plow furrows. Streams usually easily crossed and frequently bridged. The finest macadamized roads, without a rut or a loose stone, cross the country on surveyed grades from one village to another, and natural roads, good in dry weather, ran along every ridge and between the fields. The crops seemed to have been all harvested except the sugar beet, and small black flags indicated, to the commanders, fields where damages would have to be paid, so that, except when actually engaged with the enemy, these fields could be avoided.

The country was only about one-tenth covered with woods and in these patches there was little underbrush to prevent free movement of cavalry or infantry. The villages are usually in the valleys, and, as there are no detached farm houses, the country has a deserted appearance when the peasants are not at work in the fields. The day was raw and cold, but the rain had ceased. The cultivated ground was still muddy and the newly made intrenchments were very uninviting. From the front they were invisible, being dotted over with beet tops or stubble like the surface of the field in which they were located. There was no sign of conventional trace or profile and, on account of the mud, the trenches were not lined until the attack was well developed.

I noted one peculiar arrangement; an advanced trench commanded by one in rear with a third trench at the bottom of the swale between the two lines. The holders of the 1st trench

could fall back to the 2d and with an upward fire, aided by a downward fire of the 2d line over their heads, drive the assailant back out of the trench he had taken.

The infantry was intrenched in front of the crest, while the artillery gunpits were dug well in rear of it, and the guns were then run up with some difficulty by hand. On this day and subsequently it was noted that gunpits were rarely of long utility; after a few shots some new objective was discovered, and the guns were run to the rear just clear of the pits to fire upon it.

Walking along the infantry lines, the effect of the first day's work was evident; the men were worn out, asleep on their faces, but with knapsacks still on. Out to the front, through the scattering trees and orchards on the opposite ridge, could be seen the flashes of the Bavarian guns; the exact position was hard to determine, as it was uncertain as to whether the guns were in the orchard or a thousand yards back of it on some ridge beyond. There was no smoke, and there were so many reports that ranging by the watch was difficult. I saw the watch used frequently, but the most reliance seemed to be placed upon the maps by means of which the distances of natural features and buildings could be accurately determined. I did not notice the use of a range finder. In rear of the line, was a captive balloon of a sausage shape which, as it did not revolve, afforded a steady support for the observer who was in telephonic communication with the ground.

These balloons often changed their position quite rapidly, the retaining wagons travelling along the roads. From the fact that they were usually on the same flank as the cavalry division, I concluded that a large part of their duty was to watch the enemy's cavalry.

The Bavarian advance gradually developed; about 10 o'clock the infantry began to appear in irregular lines. The supports could seldom be located, as they moved to the right or left of the part of the line they were supporting so as to take advantage of concealing features; when they came into the open, it was in swarms, or rather as a second line. The reserves now and then showed heavy columns for a few minutes on some exposed roads, and the Prussian artillery then showed infantry signals and fired rapidly.

I was encouraged to note here the same mistakes that we make at our own little manœuvres. A long column of Bavarian artillery, finding itself under fire on an exposed ridge, countermarched, at a trot it is true, but every carriage came up and took its medicine from the Prussians instead of halting and making an about by piece, as could have been done by unlimbering even on a narrow road.

The Bavarian attack was pushed steadily up, on the theory, probably, that its artillery fire was shaking the Prussians. From my position I could see the attack on the Prussian left; I could count four or five lines advancing and retiring in front of the Prussian position. At the distance of three miles, in the cloudy weather, it was impossible to distinguish the dark Prussian blue from the light blue of the Bavarians, or make out the gleam of the Bavarian helmets. There was practically no smoke, and it was impossible to tell whether a given line was Bavarians advancing or Prussians retiring. Farther to the left, was a mass of infantry holding an isolated knoll—whether Prussians or Bavarians could not be determined. Still farther away, apparently on the Bavarian line, was a large mass of cavalry sheltered from view of the Prussians opposite them by intervening woods; their lances enabled me to tell that the mass was cavalry, but my glasses which I had heretofore thought excellent, would not show whether they were Bavarians or Prussians. I could not make out the colors on the lance heads or whether there was brown on the headgear.

The distances on these modern battle-fields have become so great that the officer's glass will have to be a marine glass or a binocular telescope. The advantage of power and definition at great distances will have to offset the disadvantage of small field. I have never been able to use a field glass from horseback, and on foot there is no trouble in holding the small field on the object. On the subsequent days of the manœuvres I used a Zeiss binocular magnifying 8 times and found it so satisfactory that I bought a marine monocular of the same make magnifying 12 times. This instrument cost about one-third as much as a Zeiss binocular, weighs one-third as much and has one-third the bulk (it weighs 10½ ounces, is 4¼ inches long and 2¾ inches thick), and it can be tucked in the pocket or between the but-

tons of the coat when in use. In these instruments the image is inverted by means of two sets of prisms instead of by lenses; this arrangement, it is claimed, causes less loss of light and less chromatic aberration. It has the further advantage of reducing the length of the barrels nearly two-thirds, and, in the binocular, of increasing the stereoscopic or plastic effect by placing the object lenses farther apart than the observer's eyes. The focus is constant, and once adjusted for the person using it, is never changed whether the object is at 50 yards or 5 miles.

The Bavarian advance was very slow and deliberate and was pushed up into the Prussian intrenchments, which were carried here and there with a cheer. The experience seemed to show that there was no such a thing as running or rushing, at least for men with knapsacks on their backs; there was a semblance of it but the speed was not greater than the ordinary march. The Great Halt was sounded about 2 o'clock; the Bavarian assault had been unsuccessful except on the extreme right; the single division of the VIII. Corps on the Prussian left had been severely handled at first, but had been enabled to hold on by the timely arrival of the two other divisions of the corps which had at last succeeded in coming up.

There was no cavalry action on this day either, as far as I could learn. The Prussians were required to fall back 2 miles during the evening to another position to the north and west, on the hypothesis of the repulse of the main Western Army and the necessity of making a junction with its right wing.

These hypotheses are frequently injected into the actual operations of the manœuvres in order to prevent the exercise from coming to a dead lock, to make the experience as varied and useful as possible, and also, sometimes, to keep the troops within reach of supplies which have been accumulated on the field.

There were no wagon trains proper, on the manœuvre field; a very few wagons were used to distribute forage and rations from the points where it had been accumulated.

On the morning of the 8th we found ourselves again in the mud, for it had been raining all night. The roads about Gross Karben were blocked with artillery moving northeast, and we splashed merrily along with them till we met a regiment of in-

fantry marching in 3 columns abreast, one on the road, and one on each side, having hard work in the stubble fields to keep up with the centre column. Both columns now halted and waited for orders. The sun came out and the artillery drivers at once began waxing their harness, which had turned from a mahogany color to black under the three days' wetting it had received. I handled some of it however and found that it was soft and left no black grease or dirt on my hands.

Both in the artillery and cavalry, the bright bits and scabbards of the review of last week were coated with rust; and, as the weather continued bad all through the manœuvres, there was apparently no attempt to enforce cleaning up. While looking at the pole draught and separate trace of the artillery, there was a lively fusillade upon a patrol of Bavarian cavalry which probably picked up all the information it wanted, and galloped still farther into the Prussian rear without coming within a thousand yards of us. There was no cavalry handy to give chase.

Just here I had occasion to present my official pass for the first and only time. A gendarme asked for it in what I thought was an officious way as there were other spectators about; but I did him wrong for he gave me the tip that the Emperor had gone to the Kaicher Höhe, and thither I went as fast as I could through wet underbrush, woods, and stubble fields. I was just in time to see a very peculiar attack of a brigade over open ground, where the advance to within assaulting range could have been made through thick woods to the right and left. I could only explain it on the theory that they were afraid to trust large bodies of men in the woods for fear of confusion and of losing control of them; this seemed hardly a satisfactory conclusion and I am inclined to think that it was simply the work of some routine mind that had the drill regulations down to dots. I thought, however, on several occasions, that I noticed a desire to keep out of the timber; and, though small woods often marked points in the line of battle, I did not see any determined defense of a wood during the manœuvres. They were largely utilized, however, as screens behind which artillery and cavalry were held in reserve.

This attack of the Prussian right to the S. E. of Marien Hof

was successful as was also an advance of the Prussian left, so that the Bavarians who had advanced in force in the centre found themselves crowded into a convex line of great density. The position of the centre on the Kaicher Höhe being very strong and very favorable to the Prussian artillery, the Bavarians were unable to break through, and finally fell back under heavy fire from Schloss Naumberg. The Prussian infantry following, became so dense that it fired in six ranks; the first two lying down, the next two kneeling, and the third standing. The retreating Bavarians were, in places, ten ranks deep, due to the crowding in of the flanks. After this action many of the Bavarian companies carried the little flag which indicates to the opponent that they have but 50 per cent. of their strength left.

The Germans load always by the cartridge packet and seem to have no cut off for their magazine. They fired slowly or quickly according to command, but very rarely by volleys. There being no smoke, volley firing is unnecessary and only used occasionally to steady the men. The friendliest understanding seemed to exist between the patrols on this day; the opposing patrols were perfectly content to occupy in peace a very small patch of underbrush. Umpires were probably busy with other and larger affairs. I saw a squadron of cavalry gallop from one bit of timber to another near the line of battle. The sight was so refreshing, after looking for cavalry in vain for three days, that I immediately went in pursuit. I found them dismounted in the edge of the timber, with their lances stuck points downward in the ground so that their pennons should not attract attention. They did not appear to be looking for anything so I left them. I heard that the cavalry did collide slightly, on the left of the Prussian line, and that there were charges and counter charges involving a regiment or so on each side.

The bicyclist of our party had his wheel out this day, but the ground was so muddy that when we left a road the wheel could not be taken along, so he spent most of his time going back for it; the trouble in getting the wheel on and off of crowded trains was another inconvenience which would only be compensated for by fine weather.

The orders for September 9th required the Western Army

to again fall back under cover of its artillery, the junction with the retreating main army being still in view. The Eastern Army (the Bavarians) received the reinforcement of another division of cavalry from the main eastern, or German Army, which had repulsed the invaders. The two cavalry divisions were ordered to operate on the right flank and rear of the Prussians. On reaching Gross Karben the artillery was heard hammering away on the Kaicher Höhe, but an extension of the Prussian right wing towards Petterweil was already developing.

A solid column of infantry was splashing down the hard smooth highway at a double, sending the liquid mud splashing high over everything; there was no attempt at keeping step or dressing in sets of fours, but the sound of the heavy boots on the hard surface marked the time very distinctly. A regiment of cavalry came by at a swinging trot, ten miles an hour I should say, the men all posting easily and looking cool and comfortable. I was struck by the absence of clatter; the sabres hung vertically with very little motion, attached on the near side of the saddle back of the thigh. The carbine vertically in a corresponding position on the other side. There was no flapping up and down of saddle bags. The saddle pockets on the pommel were firmly secured, as were the mess tin and picket rope on the near cantle. Even the officers' field glasses and map cases, though slung on the shoulder, were held to the body by a narrow strap to prevent their banging about. The lances (which were carried by every cavalryman—cuirassier, dragoon, hussar as well as Uhlan) were supported solely by the hand, sloping diagonally upward to the left front, across the pommel. This must have been very fatiguing to the rider, but evidently the weight of the heavy weapon in the stirrup socket was an evil to be avoided at the trot.

Out to the southeast a squadron of Bavarian cavalry was trotting around in the open meadows as though going through a series of drill movements in close order. They had drawn the fire of the Prussians and, after retiring out of rifle range, were moving in this way to escape the effect of fire from Prussian guns already in position on the hills to the northwest.

Strong columns of Prussian infantry were now seen issuing from the woods above Gross Karben and marching towards the

crossing of the Nidda, while battery after battery of artillery came down both the highways at a trot to cross at Okarben and Gross Karben. Falling in with the heavy columns I pushed on towards Petterweil. Three batteries were now firing rapidly from the ridge to the left of the road, and a regiment of cavalry was massed to the left and rear of the guns.

As I reached the ridge to the south of Petterweil the target of the artillery had vanished and the firing had ceased; the infantry were pushing on rapidly into the village and beyond. The artillery now limbered up and moved by the right flank. Moving forward but a hundred yards in the direction in which the artillery had been firing, I met a patrol of Bavarian cavalry, who, on looking down at Petterweil where there was now a brigade of infantry and some four batteries of artillery, asked me if those were Prussians or Bavarians, and quickly galloped back. There were no highways leading west from Petterweil, and some of the artillery and infantry struck out directly into the mud of the plowed ground in which they were nearly mired down; the rest of the force clogged the narrow streets of the village and pushed through to the northwest corner where a highway extended for only a hundred yards before it too disappeared in the mud.

I found myself in this latter position, when a great black mass of cavalry appeared among the scattering trees where I had just met the Bavarian scouts. Without any pause, a portion of the mass detached itself like a part of a swarm of bees; as it swept down the gentle slope it took the form of a regiment in line of squadron columns. As they came on they gained intervals by obliquing by the heads of columns, then formed line of squadrons and charged. As the objectives of this attack were scattered companies picking their way in column of fours, and batteries or platoons of artillery mired down, the regiment in many cases broke up at the command charge, each captain choosing his own objective. As the separate regiments charged, the mass behind them kept growing blacker and blacker, and the horse artillery appeared on the flanks.

The Prussian artillery, except some guns in the village streets, was ridden down before it could unlimber its mired guns or fire a shot. The infantry, struggling through the fields

in detached companies, was overwhelmed in spite of its fire by sheer force of numbers. The extension of the Prussian right wing was checked. Two regiments of infantry had been ridden down or were demoralized; several batteries had been captured; and, in a little village, were shut up about a thousand men with a battery of artillery. The Bavarians had 106 squadrons of cavalry armed with carbines, and they had their horse artillery in a position commanding the village. The problem had now reached an interesting stage, the logical sequel was the attack on the village and the rolling back of the disordered troops down the road to Gross Karben, enfiladed all the way by the guns of the horse artillery. But right here the great halt was sounded and the day was done. I was assured that the German cavalry is trained to use its carbines, but that they do not care to show their hand at public manœuvres. Others said it was not the policy to injure the dash of the cavalry by requiring it to do the work of infantry. Here was a case however where there was no infantry within reach and where much of the fruit of the brilliant surprise was lost through unwillingness to resort to fire action. From the fact that in a whole week of manœuvres I never saw a cavalryman draw his carbine from its sheath, from the omnipresence of the lance, and the glittering helmet, I believe that the Germans do not yet regard cavalry as self-sufficient, and that the carbine is considered only as a weapon of defense.

During this attack I was right in the midst of things, with a company of infantry; the squadron charging it halted in line at a distance of about 30 feet, then separating in the middle passed around the flanks and uniting charged on other units farther on.

When the assembly was sounded there were some forty squadrons that had charged, in the little swale west of Petterweil. There was no halting to form lines, but the whole mass continued moving to the northwest; each regiment seemed to have a special signal or short refrain which the trumpeter kept sounding, and each captain kept weaving his squadron in and out until he reached his regiment, when he formed on the other squadrons in line of squadron columns with close intervals. The deep mud of the cultivated fields had made the pace of the

charge very slow, but the exertion of the horses had been severe. I saw one horse drop dead from heart disease, another with a broken fore leg, a third bleeding profusely from a lance thrust in the quarter, probably due to a stumble and a rear rank file. I saw only one man unhorsed and that was due to the limb of an apple tree. When the halt sounded the cavalry was massed and dismounted, the lances being stuck in the ground. This disposition of the lance was always practicable at the manœuvres as the soil is loose, there are few stones and the lance can easily be driven a foot into the ground.

The Kaiser, with the King of Italy, the Prince Regent of Bavaria, the foreign military attachés, and other officers made up an interesting group, even in the drizzling rain. The officers generally were wearing their overcoats, the foreigners mackintoshes, and the Germans their new coat of a sort of cadet grey with a broad pleat in the back held together by a back strap. These coats are very practical; they are so loose in the shoulders that they can be buttoned up without putting the arms in the sleeves, and when the back waist strap is unbuttoned they cover the knees and the cantle of the saddle. Our overcoat has the back strap, but the pleat, the justification for its presence, has been omitted by the tailor who did not sympathize with its usefelness. The Kaiser sat chatting cheerfully in the rainfall for more than an hour, by which time the umpires had all made their reports, and he had before him a map of the movements and present position of every force. He then delivered his critique, or part of it, and the troops were ordered to their billets.

The cavalry vanished as if by magic, each regiment trotting off on a bee line by the map for the village to which it had been assigned, preceded, several hundred yards or more, by a junior officer with an orderly who made inquiries as to roads, etc., in order that the column should not be checked nor the colonel bothered by such details. As I found myself at this time a solitary figure at the end of the nearest stretch of highway, I became a bureau of information, and thanks to my study of the map, was able to conceal my very limited knowledge of German, as I pointed out the villages asked for.

The result of the day was that the Western cavalry divis-

ion had been defeated and driven off by the Eastern cavalry corps led by the Kaiser in person, and the extreme right of the XI. Corps had been surprised and roughly handled at Petterweil, losing several batteries of artillery and a regiment or two of infantry. The surprise of the cavalry attack was apparently complete. The position of the Eastern cavalry corps was probably known to the superior officers of the Prussians but, owing possibly to the mud, which hampered cavalry orderlies as well as bicyclists, the smaller units had no warning of the attack. There appeared to be no Prussian scouts on the ridge southwest of Petterweil.

The orders for the next day, which was the last one of the manœuvres, changed the composition of the opposing sides. The Prussian VIII. and XI. Corps joined the Bavarian Corps, as reinforcements from the main German Army. Each corps furnished a division to represent the Western Army in its position of the evening before, west of the Nidda.

Thus four divisions—two Bavarian and two Prussian—outlined the enemy, which was of course to be driven from the field on this last day. Politics must be considered in these great manœuvres. It is well that the Prussians should act together in rivalry against the Bavarians. But, to prevent jealousy, the Prussians, whose king is Emperor of Germany, were assigned the rôle of invaders and compelled by suppositions to fall back day after day. The Emperor, on the day just described, took command of the two cavalry divisions of the Eastern Army and with them, it was announced, turned the tide of battle and drove the opposing cavalry (the Prussians) from the field. The clear morning of the last day found me again on the railway platform at Gross Karden, but things being suspiciously quiet, I ran back on the next train to Vilbel where I found I had gone too far, for a heavy column of Eastern artillery, cavalry and infantry had crossed the track to the west, and were occupying the ridge west of Dortelweile, from which their artillery was hammering away viciously.

After a delay of an hour which seemed to me half a day, I succeeded in getting a train back to Gross Karben and was swept up the hill to the left through the village of Kloppenheim with the German attack. The ground gave good cover,

due to the hills, orchards, sunken roads and villages, and the infantry advanced in solid lines from cover to cover. The firing was very rapid and at close range, and I soon changed sides and found myself in the ranks of a Prussian regiment representing part of the Western Army. They were falling back by alternate companies before the Eastern advance.

Suddenly a black mass appeared swarming over the ridge 1000 yards to the west. The captain's whistle called attention, "There is the enemy's cavalry," he said, "but don't pay any attention to it yet." I was in some doubt about the cavalry as I could not see any lances or pennons, but they had lowered them to escape recognition or pass for artillery. The mass began to advance rapidly; we could now make out the intervals between regiments as they came down the slight slope to attack directly from the rear. The Western infantry, having its hands full in front, allowed the cavalry to approach to about 600 yards, when it simply faced about and commenced a very rapid fire; the companies that had been alternating in retreat now forming a continuous line. On came the cavalry, ground scouts well ahead. I look for the lances but cannot make them out; nothing but a thundering dark mass of horses. I miss the gleam of the sabre blades that belongs to my idea of a cavalry charge. The distance has lessened to a 100 yards, the infantry fire ceases, the officers leading the cavalry line signal with their sabres and shout "We are going through." Instantly the flanks of the infantry platoons break to the rear and each platoon forms a compact circle about its leader. Through the intervals rush the cavalry platoons. First the leader, then the centre files and the others tailing off on each flank like a flock of wild geese. The leader checks his speed only an instant, his men are again in line, and away they go at what they have taken for the supports of our line. They have not noticed that the second line has no brown covers on its helmets and they ride down their own friends.

Two hundred yards in rear comes a second line nearly as strong as the first; they also charge through, and down upon their helpless Bavarian friends. The reserve or third line is held in hand, and the regiments that have charged are rallied and make a second series of charges, this time by regiment,

upon the flanks of retreating and demoralized infantry to the north of the Kloppenheim road. I count 33 squadrons as they cross the valley below, nearly 4000 lances—seven regiments. After the first charge, I allowed my enthusiasm to carry me away from the protecting infantry and into the path of the second attack. I was made gratefully aware of the perfect training of these cavalry horses by being able to dodge through the intervals without coming in contact with an unmanageable animal.

The clouds were now thickening around the poor invaders who were making a last stand on the high ground northeast of Kloppenheim. The Bavarian Corps were massing in the sunken road through the village and to the west for an assault in force on the right flank and rear, while the two Prussian corps were pressing in on the front. Suddenly there was a swell of drums, taken up all along the line; a dull heavy throbbing, more like the roar of an angry crowd than like the sharp rattle drums usually make. The lines advanced steadily to this accompaniment, four, six, and eight ranks deep, then with cheers dashed forward on the run, and the affair in my vicinity was over. For a long time we could hear the quick fire at other points, the cheers, and then came the notes of the great halt, which sounded again and again as some distant batteries persisted in pounding the air and would not be comforted.

The regimental bands that had plodded faithfully with their comrades all through the manœuvres now struck up, and the men stretched themselves in the welcome sunshine, while the reports came in and the Kaiser delivered his final critique. Then spectators and actors, Crown Princes and Crown Paupers, jogged gaily to martial music down the road past the old moated grange, and through the hamlet of Kloppenheim, to the railway.

A friendly hand gave me a lift into a baggage car where were a dozen officers of all ranks and all arms; we found seats on boxes and trunks and smoked amicably all the way in. My ignorance of German proved no inconvenience on this occasion, for I could salute and bow, and say "Bitte" when I wanted a light or stepped on some one's spurs, and that was all the conversation on which any one ventured. Englishmen in an om-

nibus could have been no more reserved than these German officers were among themselves. Perhaps they were tired of manœuvres or were too full of them for utterance. As we whirled along we passed regiments embarking at every siding. The railroads were already at work showing the efficiency of the system for returning the troops to their stations.

GENERAL IMPRESSIONS.

The most striking thing about the manœuvres was the matter-of-course way in which the exposure and fatigue connected with them was accepted; it was a taste of real war at which no one seemed to grumble. There seemed to be a rivalry between organizations as to their ability to stand hard work, and as several men told me, their companies had turned out their full strength every day. Another thing was the silent and practical way in which all bodies, from squads up, were handled. Commands were seldom heard; the men simply followed their leaders. They were attentive without being at "attention." There was no nagging; the file-closers had nothing to say; there was no straggling, the rear files of a company were always kept closed up, but the effort seemed to be voluntary. The whistles of the platoon commanders were easily heard above the firing and the men then turned their heads alert for signals or commands. Occasionally a bit of barrack yard drill would crop out, when, for instance, a company would mass to stack arms after the day's work. Then we would have facings, marchings, haltings, etc., loud enough to split your ears, all the platoon commanders barking at the same time. The pieces were stacked without bayonets or special swivels, simply interlocked without trouble or delay by means of the space left between the end of the cleaning rod and the barrel. The galloping orderly was not often in evidence, and when you did see him his horse never differed with his rider as to details of space or direction.

The cavalry on the roads moved at a swinging trot, posting easily, and looked better than they did at the review, where they were required to sit close at a trot, a trick to which their saddles are not adapted and at which they made a poor showing.

They pay a ruinous penalty for carrying the lance, even videttes and patrols seemed afraid to dismount. When a scout

did so, he first stuck his lance in the ground, then rode a few yards away before dismounting. After mounting, he rode back and picked up his "pole." Of course the sabre was never drawn.

The cavalry was finely horsed, all their animals showed clean legs and light well-carried heads, but while showing traces of good blood, were not of the race-horse type. The artillery horses were coarser, often with heavy heads and hairy legs. The batteries did not have the mobility of our own. They never took the gallop, trotted only on the highways and did little or no manœuvring in going into position. They were almost invariably employed in masses, three or more batteries together.

I had, much to my regret, no opportunity of observing the horse artillery. I saw no tentage, the troops being billeted in the villages.

The cavalry at the first contact, and during the first three days of the manœuvres seem to have done next to nothing. It was apparently held in mass, each side not daring to move for fear of the other, and not willing to risk a struggle without some advantage. The balloons probably had much to do with this, and doubtless many feints were made, only to be checked by the influence of the "Hello man" in the air.

The German uniform is not uncomfortable nor dangerously conspicuous, with the exception of the helmet which betrays its wearer everywhere. It is surprising that it is still worn in simulated war. Its martial appearance is apparently too attractive to allow of its being abandoned. The helmet and lance are mediæval survivals whose traditions modern utilitarians have not yet been able to overcome.

The silent, simple, rapid manœuvring of the cavalry was most impressive. It was simply a question of leading and following, of manageable horses and attentive men.

The officers were never seen turning in the saddle; their attention was fixed in front. The men had only to follow their leaders. For an American cavalryman this was the most instructive feature of the manœuvres.

AN ACCOUNT OF THE PROPOSED PROGRESSIVE FIELD TRAINING YEAR AND MILITARY DECENTRALIZATION AT FORT NUECES.

By First Lieut. CLARENCE R. EDWARDS, 23d U. S. Infantry.

ON March 1, 1899, at Fort Nueces, the station of the 30th U. S. Infantry, officers call was sounded, and when all the officers, in obedience thereto, had assembled, the colonel addressed them as follows:

"Gentlemen, we have just completed the four months' drill required by General Orders of this Department, in conformity with A. R. 230, and previous to that, drills were held every day except Saturdays and Sundays, since last February 28, 1898.

"In glancing over the past year's work I have constantly been reminded of the changes and the evolution that have occurred in our little army—even during the last *ten* years—and I can't help but feel that this evolution is in the right direction —it means work, its intention, the object of all military work,—*training*.

"I will be pardoned if I say to you that I believe that this our regiment, is second to none in the service. I have religiously tried to carry out in spirit and to the letter all orders and instructions; if I have succeeded or no is for the Commanding General and duly authorized Inspector to tell—if I have failed, it is not from the lack of support of my officers.

"Still I am painfully conscious that there is much to be accomplished. I feel that there has been a waste of labor. I notice that there is a woeful lack of interest in the second half of the two hours company close order drills—and I must confess I find no marked improvement over the last year's results.

"Whether I would have adopted the same kind, method, time, duration and sequence of the various trainings, had not this been laid out for me, it is perhaps not proper for me here to state. Still, I can't help but feel that the greatest weaknesses of our system are a lack of a progressive field training year, and the centralization of initiative authority away from the com-

manders of units to whom in successful wars it must properly belong.

"I have therefore drawn up an experimental programme for the coming year, which after explanation has gained the sanction of the War Department. It is epitomized as follows:

Commencement training year . . . . August 15.
Companies . . . . . August 15–November 15.
Battalions, November 15–January 15 (10 days suspended holidays).
Regiment . . . January 15–February 28.
Manœuvres post . . . . . March.
Manœuvres—combined . . . April.

"Recruit instruction, non-commissioned officers' school, reconnaissances, map making, etc., and Lyceum season, gymnastics, calisthenics: May, June, July, to August 15.

"Therefore, commencing May 1st there will be no close or extended order drills for any soldiers considered proficient by their captains.

"There will obtain during this seasons a progressive course of gymnasium work under special officers, followed the last half of this season by short sharp drills, probably early in the morning, in calisthenics with and without arms. The recruits and men only partially instructed, and specially awkward or careless, will be placed under the proper officers and non-commissioned officers, with orders to thoroughly instruct these men in all duties, including target practice, that will qualify them to enter their respective companies, on as nearly an equal footing with their comrades as the short time will allow—August 15.

"The orders governing the above, also prescribing the various ceremonies, fatigues, police, etc., will, during this season, as has been the custom, be published from time to time as I may deem proper.

"But now, gentlemen, comes the point of these remarks, and it is to you captains that I will specially speak. I purpose to try and inaugurate with your rank what I feel has been denied mine—*i. e.*, authority of your rank with attendant responsibility.

To this end agreeable to the regulations and orders, and compatible with only the necessary post duties, I intend to turn

over to you your companies on August 15 next for the purpose of training. Your special object during this three months period will be to present to me, at least by November 15, next, your commands as trained and conditioned units, fit to enter a battalion ready for any garrison or field service.

"Were discussion invited I can easily fancy the objections to this system. You will tell me that it is bound to fail, because there is no retirement in our service for rank,—and therefore there can be no distinctive penalty for incompetence, carelessness, etc. I will anticipate this objection by stating to you that I will furnish the penalty, under the present laws too; for if failures condemned, and even reported, on annual efficiency reports, are not the method to secure the desired efficiency; then, may I recommend to the War Department that you command a skeleton, that, at least will be no menace to the rest of our regiment. This report then would form a part of an unenviable record to submit to an examining board. And, according to theory at least, even if the incompetent or delinquent captain under our laws must be tolerated as such, nevertheless this expedient would or should insure the service against this man's receiving a higher commission, to there inflict his already established unfitness on a larger and more important unit.

"In fact could this system be carried out, and graded retirement become a law, I would abolish all examinations, and let the yearly and other records as to qualifications together with the moral character determine the fitness for promotion.

"Now, gentlemen, I have here a memorandum of the drills and instructions, by regulations and orders required and prescribed for the proficiency of the soldier, with which you are all familiar, it is as follows:

Setting up exercises,—Drill regulations,
Koehler's Manual of Calisthenics,
Butt's Manual, Physical drill with and without arms,
School of the soldier, including bayonet exercise,
School of the Company,
School of the Battalion,
School of the Regiment,
Guard duty,
Artillery Drill,

Litter Drill and first aid,
Outpost duty,
Advance and rear guards,
Extended Order Drill,
Canvas Drills, including shelter tent and heavy canvas,
Intrenching—the building of fascines and gabions,
Reconnaissance,
Wall scaling,
Rope climbing,
Target practice, including pointing and aiming drill,
Cooking and messing,
Castrametation,
Non-commissioned officers—A knowledge of the Drill and Army Regulations, Guard Manual, Manual for Hospital Corps, Troops in Campaign, Rudiments of field engineering.

"To these let me add as of special value, training in fire discipline or fire control,—and let me recommend studies in the art of troop leading.

"This art I consider the most important and its successful accomplishment the most masterful in our profession.

"About November 15, next, accompanied by my field officers, I will carefully inspect each of your companies. This inspection will probably consist mostly of problems for the companies in minor tactics, or manœuvres; where incidentally the interior economy and discipline will also become apparent.

"Captain A., I believe, is noted for his knowledge of the Drill Regulations; Captain B., for the campaigns and wonderful marches in which he has participated; Captain C., for the exactness and smartness of the line of his shelter tents; Captain D., for the number of orderlies which his company captures; Captain E., for his company fund and excellent company mess; Captain F., for the number of old soldiers and harmony existing in the company, etc., and so on. All excellent things, gentlemen, for which I would commend each, and say to all try and acquire all, and the rest.

"This final inspection will not try to determine any relative order of merit, it will simply demonstrate those proficient, and if any be deficient, in what particular and to what degree. In this thorough inspection I trust, that I may be aided by the

more experienced judgment of the Department Commander, in addition to his inspection of my regiment at the final or Department manœuvres.

"Naturally there are innumerable obstacles in this proposed scheme, notably the constant change of the enlisted personnel,—the loss by discharge of trained, and replacement by untrained men—requiring a recruit squad during the entire year, in spite of the special recruit and awkward squad under training between May 1st and August 15th.

"This obstacle I will try and minimize by enlistment of the proper contingent to arrive during May. Again I am so sanguine of the comparative merits of this progressive training season, that I feel we may *select* from old soldiers, and that our loss will be 50 per cent. less after one or two years' trial.

"Again I have in mind the protests from the quartermaster, adjutant, commissary, canteen officer, treasurer, officer in charge of the garden, etc.

"But experience with the trials of these officers during 80 per cent. and 70 per cent. drills convinces me, that, though compromises are bound now and then under our questionable extra and special duty system, to obtain, still results show that the care and repair of public property and supplies has not suffered, and the gain to the line—a soldier's first duty—has been much more than commensurate with all the best interests of the service.

"Great strides can also be made on the police of the post, the annual work, etc., between May 1st and August 15th.

"With your kind support and coöperation I have no fear of successfully overcoming all the other obstacles always incident to any decided change.

"Anyway I can promise you the full strength of your companies at least twice a week, with a probable average of three times a week, if not more. In fact I have had in mind during the company training season the advisability of detailing two companies for a week at a time to perform the guard and police of the post.

"This being a regimental post and the guard strength 20 privates and 3 non-commissioned officers—a total of 23—will give each soldier at least three nights in bed,—and this method if a

little hard on the company officers, at least will have the advantage of allowing the officers most interested to thoroughly instruct their men in this very important duty.

"During this company training I will have to deny, in all but unusual circumstances, leaves of absence and furloughs.

"During this season I shall try and leave each captain as much as possible to his own hours, methods and initiative. At the same time I shall not abandon you, gentlemen; I will constantly advise myself of your ways and means and give you credit for successful results. The idea being to grant you all power possible, that I may at the same time hold you absolutely responsible.

"As you must well know it is always my pleasnre to aid by suggestion and advice any one who cares to apply to me for same.

"That there may be some uniformity I will make a few suggestions *only*, that are probably a little out of the ordinary:

1st. That captains inaugurate among their subalterns and non-commissioned officers a corresponding system of decentralization.

2d. That all officers keep in mind the inestimable value of example. Never require a subordinate to go where you won't lead; nor to do what you have not already proved that you can do, or are heartily willing to attempt to do.

As is a decentralized captain so is his company.

3d. That, at least once a week, a one-day's road or field march be made; and each month, a two or three days' march with camp and without transportation.

The object being that by November 15, the company will be trained and conditioned to march with full pack 15 miles.

4th. That during the last half of the training season these marches be accompanied or terminated with only—the necessary —individual—and the required company target practice.

"You will notice that this matter of target practice alone is the only matter for which I had to gain the sanction of the War Department—unless I except the number of hours prescribed for litter drill and first aid, which now, under the above sanction I may, as I will, leave to the discretion of the captains. Whenever the chance offers I would vary the ground on which I held company target practice.

5th. Drills specially devoted to the accurate transmission of verbal messages.

6th. That captains superintend the first issue of shoes to men of their companies, to insure a proper fit.

7th. Practical instruction in entraining and detraining.

8th. That the most careful attention be paid to the respect due between officers, and between officers and soldiers.

"On November 15 I will, under the same spirit of decentralization turn over one battalion to the lieutenaut colonel and the other to the major. These officers will be advised at the proper time of my special views and recommendations concerning the training of their important tactical units.

"Suffice it to here state that the object will be, as heretofore elaborated, to present to me, at least by January 15th next, thoroughly trained and conditioned battalions, fit to take their proper places in the best regiment of infantry in the service.

"To this end special attention to marches and target practice will be paid.

"To secure full attendance during this season my plan is to alternate the post duty between battalions; whether this division of duty and training should be by alternate hours, days or weeks, or a combination of all, the trial that I intend to give will best demonstrate.

"Perhaps it is as well to promise these field officers the same measure of praise or condemnation, according to results, as is to be the lot of your company commanders.

"On February 28th, if not two weeks before that date, the season devoted to regimental training, according to my programme, I hope to be in every way ready and equipped to instructively enter upon the forty days of manœuvres required by General Orders.

"The practice march under the strictest service conditions will probably take place during the regimental season. And by the end of March I expect to be eager to inform the General Commanding that my regiment is ready and keen to march and join other troops of all arms, which I pray may this year be assembled for combined manœuvres.

"These combined or so-called autumn manœuvres already prescribed but as yet denied us, though even allowed the militia

are the main object of, or rather incentive to, this progressive year's training.

"Don't give them up, they are bound to come; I see it in the signs of the past few years. If their admitted valuable lessons be wanting to us and ours again this training year, why then let us be comforted in the assurance that by the end of the next our regiment will be even better able to excel when brigaded with others and with different arms.

"That is all, gentlemen, you are excused. Up to May 15th next the usual daily programme will be carried out."

And then the officers of the 30th Infantry left their colonel, a very few said, "in the enthusiasm of his second childhood." The rest were delighted. One of them said: "Come to think of it from the standpoint of a soldier, there is not much incentive to do 'fours right' properly, when, however well he does it, he must drill it again for the next thirty years."

Another said: "Why! my company would much rather march down in the hot sun and dig in those field-works for three hours, nearly buried in dust, than to get two hours of fours right.

"And you all know how every company here hails with delight any chance to spend the afternoon sawing wood on litter drill days.

"In fact, I must say that I share their delight, for this hospital drill has become an eternal grind; for, months ago, recruits excepted, they had learned it all. Give me a soldier for any work where there is a definite object."

And then these officers went home to think and plan the next year's work, and the consequent interest and enthusiasm permeated the whole command.

There can be no nation on earth to-day so well equipped, by tradition, inheritance and historical facts, for the intelligent practice of self-reliance, invention and initiative as are we; and how do we make use of these qualifications? By gradually stamping out in the military branch individuality and responsibility.

History tells us how well the army under unfettered hands has performed all tasks set it, and also records the failures due to the centralization of power by the civil away from the proper military authority.

Generals Grant, Sherman, Sheridan, Pope, and Schofield and others, have in writing vigorously condemned this tendency and in an article on the evil of centralization by James A. Garfield—a member of Congress from Ohio—published in the *North American Review*, 1878, appears these protests and charges.

The author even goes so far in detailing the "serious conflict of jurisdiction and command" occurring between Secretary of War Jefferson Davis and General Scott and to state that "It has been asserted * * * that this [Secretary Davis'] usurpation of authority was the plan pursued by him and his immediate successor [Secretary Floyd] to place the army and its equipment in the hands of those who designed either to use the military establishment against the Union, or to cripple it for effective service against rebellion."

However, this is a feature affecting the whole rather than the parts, which is merely mentioned to show how decided have been, and are, the views of our greatest military authorities in favor of decentralization.

Naturally to obtain the best professional modern methods and current opinions on these subjects we have only to take the examples and ideas of European powers, upon whose very existence depends the best knowledge and application of the art and science of war. To gain this information I know of no better way than to rely on the excellent publications of the Military Information Division of the A. G. O. Specially would I call attention to Nos. 12 and 15; "The Autumn Manœuvres of 1895 and of 1896 in Europe."

Under the caption "Tactics" in No. 12, in speaking of the attack of the First Guard Division, I quote "The brigade commanders then sent for their regimental commanders and designated the place of each regiment in the line, with its objective of attack. They next ordered a battalion from each regiment to report to them as a brigade reserve. The brigade commanders' duties were now only to watch the attack and determine when to put in their reserve. The colonels next rode forward to their battalion commanders and designated the place of each regiment in line, with its objective, and also one battalion to report as regimental reserve. The battalion commanders then designated one company as battalion reserve and

ordered the remaining three to advance to the first position of the fighting line, in company column. This disposition was made beyond the effective range of artillery and entirely beyond infantry fire. There were now two battalions left from each regiment for the fighting line. In each company the first platoon was deployed from the original fighting line at intervals of one or two paces—generally one pace. The second and third platoons followed at a distance of not less than 250 yards, this being the zone of dispersion of shrapnel. When everything was in readiness each company advanced, taking care to conform to the movements of the companies on its right and left. The distance at which the supports followed the firing line were left almost entirely to ground and to the discretion of the officers in immediate command. In order to maintain communication with his platoon, the captain took with him two field musicians, and the commanders of the first and second platoons each took one. In the early stages of the action these men could be sent to and fro with messages, taking advantage of ground or crawling where there was no cover. The company front is the longest line controlled by any one officer in the firing line. It is certainly a weakness of the firing line of a regiment to have as many independent commanders as there are companies. The Germans say, however, that this is simply the inevitable, which it is better to recognize and accept, in time of peace, than to expect impossibilities in war and be disappointed on the battle-field. The major would certainly direct his battalion firing line on the drill ground with ease but in battle it is out of the question to expect any one man to control a skirmish line of several hundred yards in length. The only thing to insure continuity is to impress on each captain that he is to lead his company more with a view of compassing the general task as set the battalion or regiment, than of accomplishing individual success."

Again in No. 15, under heading "Infantry." "It becomes the duty of the responsible commander to determine the circumstances under which it is necessary to depart from the principles of the deep order formation. Everything seems to be left as far as possible to the discretion of all commanding officers within their own proper sphere. All officers, from cap-

tains up, continue to use their own judgment and to make their dispositions according to the nature of the terrain and the circumstances of the actions."

Speaking of the benefits of the tactical instruction conveyed by the autumn manoeuvres in England, this same No. 15 quotes the English service paper *Broad Arrow*,—"The good results of many years of company and field training are becoming apparent. Officers, non-commissioned officers and men have been taught to think. For the non-commissioned officers —much more for the men—to think for themselves would, a few years ago, have been deemed rank heresy, if not direct insubordination. Now, if the section leader fails to realize the situation, and fails to act, if necessary, on his own initiative, he is blamed. The result is that the mass of men are now composed of intelligent units instead of inert atoms."

TENT PIN EXTRACTOR.

By Lieutenant SAMUEL D. ROCKENBACH, 10th U. S. Cavalry.

THE extractor consists of a pick helve, the larger end of which is squared and fitted with an iron fork of $\frac{3}{16}''$ iron 1″ wide, bearing an eye. The fork is secured to the helve by two $\frac{1}{4}''$ rivets. To the eye of the fork is attached a $\frac{3}{16}''$ iron chain three feet long. On the under side of the helve is secured by $\frac{1}{4}''$ rivets a triangular-shaped iron shoe, or fulcrum, made of $\frac{3}{16}''$ iron 1″ wide, except at the curve, where a 3″ piece is welded to prevent the fulcrum sinking into soft earth (see Fig. 1).

To use (see Fig. 2): Place eye close to pin, handle nearly vertical, make three turns around pin with chain (smooth iron pins may require four turns, or end of chain held), grasp handle with right hand, press downward.

Advantages: With the extractor any pin can be drawn from the hardest ground easily, quickly, and without breaking the pin. The present method is to knock the pin back and forth and sidewise till loosened, or prise the pin out by inserting the

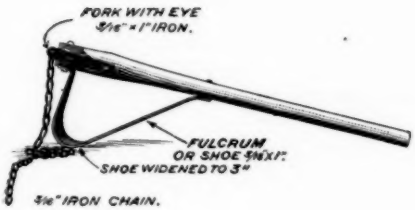


Fig. 1. *Scale 1/2*

Fig. 2.

point of a pick under the notch of the pin and pressing downward. The first method is slow, and in hard ground the pin is broken off. The second method splits the pin off above the notch if the ground is at all hard, renders it unserviceable and leaves it in the ground. The extractor overcomes these difficulties and saves at least 40 per cent. of the pins.

The disadvantage is that it adds to the weight to be carried by troops and another item to the too many already on hand, but it is believed that wherever tents are carried there can be carried one extractor to each tent, and the saving made in pins more than pay for carrying the extractor.

Reprints and Translations.

WIRELESS TELEGRAPHY AND ITS MILITARY POSSIBILITIES.*

By Captain W. P. Brett, R. E.

(*From the Journal Royal Artillery Institution.*)

No excuse I think, is needed for bringing this subject to the notice of a military institution, as the successful conduct of military operations is at the present day largely dependent on the facility with which intelligence can be transmitted and orders conveyed.

It is necessary to remark at the outset that by the expression "wireless telegraphy" it must not be understood that electric conductors are entirely dispensed with, as will be evident if you will look for a moment at the number of wires about the floor and roof of this room. The term implies only that intelligible signals can, under certain conditions, be exchanged between two stations without their being connected with each other by the usual conductor. In fact, by one of the systems which I shall try to explain to you, a greater length of conducting wire is required than with the ordinary direct method, but the wire is not run between the two stations. On the other hand, with another system, which I shall call "Marconi's," the amount of conducting wire is reduced to quite a small amount.

There is a tendency on the part of many people to form a somewhat exaggerated idea as to the capabilities of any new scientific discovery or invention, so that it will not be out of place to tell you at once that there is no sign yet of any system of wireless telegraphy which will come as a rival to the existing telegraphic methods, or even to the visual methods of signalling adopted in the naval and military services. But there have now been discovered some additional facilities for communication which may, under certain circumstances, prove of great value. The tendency to over-estimate the capabilities of a scientific contrivance is very natural, for the general public can do little else but take the opinions of well-known scientific men, some of whose statements should be accorded a poetic license. I have in my mind an article on "Some Possibilities of Electricity," which appeared in February, 1892, in the *Fortnightly Review*, and attracted considerable attention at the time. I hope you will bear with me if I read a few short extracts from this article, which, prophetic in 1892, is still prophetic. The only thing that can be claimed is, that one step (perhaps a considerable one), has been made towards fulfillment.

* A lecture delivered at the Royal Artillery Institution, Woolwich.

"Whether vibrations of the ether, longer than those which affect us as light, may not be constantly at work around us, we have, until lately never seriously inquired; but the researches of Lodge in England and Hertz in Germany give us an almost infinite range of etherial vibrations or electrical rays from wave lengths of thousands of miles down to a few feet. Here is unfolded to us a new and astonishing world—one which is hard to conceive should contain no possibilities of transmitting and receiving intelligence. Rays of light will not pierce through a wall, nor, as we know only too well, through a London fog; but the electrical vibrations of a yard or more in wave length will easily pierce such mediums, which to them will be transparent. Here then is revealed the bewildering possibility of telegraphy without wires, posts, cables, or any of our present costly appliances. Granted a few reasonable postulates, the whole thing comes well within the realms of possible fulfilment. * * * An experimentalist at a distance can receive some, if not all, of these rays on a properly constituted instrument, and by concerted signals, messages in the Morse code can thus pass from one operator to another. Any two friends living within the range of sensibility of their receiving instruments, having first decided on their special wave length and attuned their respective instruments to mutual receptivity, could thus communicate as long and as often as they pleased by timing the impulses to produce long and short intervals on the ordinary Morse code. * * * This is no mere dream of a visionary philosopher. * * * Even now indeed (remember, speaking in 1892) telegraphing without wires is possible within a restricted radius of a few hundred yards." In spite of this prophecy we are not yet within a reasonable distance of seeing our familiar telegraph posts and wires disappear from the face of the earth, however desirable from an æsthetic point of view such a consummation might appear. We may expect this when the facilities offered by telegraphy without wires are equal to or greater than the facilities given by the use of wires. At present this is very far from being the case. Nor can one at present see the probability even of wireless telegraphy ever equalling in its facilities of communication telegraphy with wires, although no one will venture to set limits to the possibilities of scientific discovery.

I should make one word of personal acknowledgment before putting before you the two systems by means of which a certain degree of success has up to the present time been achieved. I must myself own to a certain degree of diffidence in bringing the subject forward, as being by no means the individual best suited to do so. Partly from curiosity, but mainly with a view to investigating the possibilities of wireless telegraphy from a service point of view, I was induced to make some experiments with apparatus of my own design, and constructed under my own supervision, following as best I could any instructions I could obtain, the best of which, however, were somewhat meagre. The results obtained were encouraging, and the subject soon exerted a fascination, so

that I placed myself in communication with those experimenting on the same lines, from all of whom I received the greatest assistance.

After this, I am afraid, rather long and tedious introduction, I must at once proceed to explain to you one of the systems under consideration. Taking the subject in historical order, I shall first describe what is known as "Preece's system."

Early in 1895 the cable between Oban and the Isle of Mull broke down. Here was the opportunity of putting this system to a practical test; it was at once seized upon, the apparatus was installed, and communication established by using parallel wires on each side of the channel (I believe about 3 miles across), and transmitting signals across this space by means of these (so-called) electro-magnetic waves. Previous to this, in 1892, intelligible signals were experimentally transmitted from Penarth to Flat Holm in the Bristol Channel—a distance of a little over 3 miles. It was the experience gained in those experiments which led to the particular arrangements adopted at Oban, and these arrangements I shall describe shortly. It was not by utilizing any new scientific discovery that Mr. Preece was able to do this, but, making use of certain scientific facts shown by Faraday and Henry as laboratory experiments, and bringing them up to date by using the telephone as a detector, he was able to achieve success over distances previously considered impossible. (If Faraday had known the telephone what would he not have discovered!)

Let me show you the fundamental experiment on which the system depends. I am rather ashamed of the simplicity of the contrivance, and the only excuse I have for showing it to you is that this is the original experiment of Faraday and carried out probably by the very apparatus that Faraday used. Here it is (*showing it*). It was picked up covered with the dust of years at the R. M. A., where it had been lying, I am afraid to say how long; and of course you know that Faraday was once science lecturer at that Institution. First of all a little explanation is necessary before showing the experiment itself. One of the best known phenomena connected with the electric current is, that in the vicinity of a wire conveying it, magnetic forces are experienced which disappear when the current ceases to flow. Now I will ask you to imagine a wire stretching from this wall to that across the room. Suppose a current to be started in that wire by depressing a key. The current at first is zero in strength and rises to its steady maximum value, taking usually only a very small fraction of a second to do so. During the time of the current rising there is thrown off from the wire conveying it, as from a centre, a so-called electro-magnetic wave. Supposing another parallel wire stretched across the room and forming part of a closed circuit, the expanding electro-magnetic wave will wash this second circuit, or a portion of it, and a converse action will take place, that is to say a momentary current in this second circuit will be induced. I say momentary, because this wave motion ceases when the current has attained

its steady value. Suppose the current in the first wire to be now suddenly broken; the ether is released from a state of strain, and a wave in the reverse direction results, causing a second momentary current in the distant circuit.

(Experiment shown:—Two parallel coils of insulated wire, separated from each other by a few inches of air. One coil connected with a battery and key—the circuit of the other closed through a galvanometer. On depressing key, a momentary disturbance on galvanometer results. On releasing key another momentary swing of galvanometer needle in opposite direction to the first is seen.)

In the experiment just shown, when the key is depressed I ask you to imagine an electro-magnetic wave, which starting from the surface of the first coil, washes the second coil whose circuit is closed through the galvanometer, and you notice the galvanometer needle swing. On releasing the key the strain is released, and the return wave is started. Accordingly a momentary deflection on galvanometer, but in the opposite direction, results. The effects are small and weak, you see, in the extreme, but that illustrates from what small beginnings practical results sometimes follow.

This, then, is the laboratory experiment, the parent of the system of the wireless telegraphy we are considering. We can gather from this experiment what are the desiderata to enable the actions just described to take place across sufficient space for practical use in transmitting signals. In the receiving apparatus, first of all, we must have an instrument very much more sensitive than any galvanometer yet constructed, and one, moreover, that is better able to respond to impulses which rapidly alternate in their character. This we find in the telephone, which takes the place accordingly of the galvanometer. In the transmitting apparatus we require to produce (automatically for choice), sudden rises and falls of current (current rushes), and the more sudden the impulses the better will the distant telephones respond. In addition to this we want two parallel circuits of considerable length.

I have here arranged two such parallel circuits a few yards apart across the room and completely separated from each other by an air space. One of the circuits (the receiver) is closed through a simple telephone. The other, the transmitting circuit, contains a battery, key, and, in this instance, a simple automatic interrupter. The interrupter "makes" and "breaks" the circuit with considerable rapidity—about 260 times a second—and on holding the telephone of the receiving circuit to the ear, the current vibrations are detected. If the transmitting key be depressed for long and short intervals of time in accordance with the Morse code, the signals can be read accordingly.

(Experiment shown: Sending a message across the room, one of the audience taking the message on the telephone.)

The current interrupter used in this experiment is really a small motor used for driving a small ventilating fan. The fan is removed and

an automatic interrupter substituted. The experiment just shown was carried out with what is really a model of Preece's system.

It appeared to me at first somewhat a disadvantage that the vibrations of that receiving telephone cannot be heard all over the room, but this fact will serve to emphasize the main drawback of the system, namely, the great weakness of these transmitted signals, natural enough, seeing that the energy which operates the telephone is only a very small fraction of the energy radiated and the source of the energy that produces the signals is situated at this distant station.

I may at once attract your attention to the difference in the nature of the signals received with Preece's and with Marconi's apparatus.

(Experiment shown: A few signals from a "Marconi" transmitting apparatus sent to a "Marconi" receiving set at the far end of the theatre. The noise of the vibrating hammer of the receiving set was heard all over the theatre.)

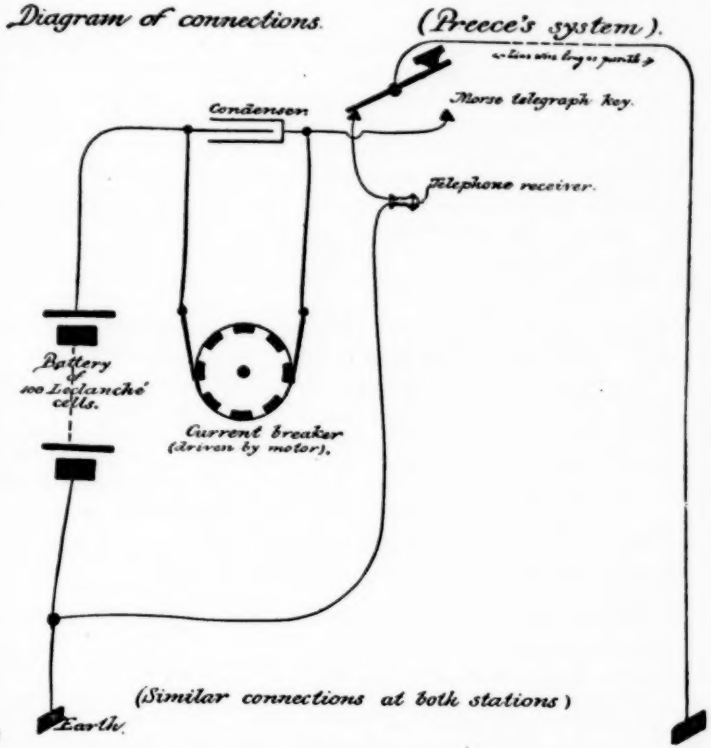
The apparatus which signalled is one I had specially made to make noise enough to be heard all over a large room; it is not one of Marconi's own sets, though constructed on his principle. Marconi's sets are very much more delicate and sensitive. In Marconi's system a contrivance at the receiving station—which is very sensitive to these etherial waves —sets in action energy located at the receiving station. The audible signals are produced, not by this very feeble amount of energy transmitted, but by a local source of energy, viz.: a voltaic battery put in action by the transmitted energy. There are many devices in common use for putting in action energy situated at a distant station, and for an example I might give you the illustration of firing a gun electrically. You have a gun tube in the gun, a key some distance off, and a battery located anywhere; and the only amount of energy that you have to put into the circuit is the small amount required to depress the key, but that sets in action the battery; the battery sets in action the gun tube, and the gun tube brings in action the huge amount of potential energy stored up in the cartridge. So that you see that there is nothing new in the arrangement of using a small amount of energy to bring into action a much larger amount. It is done in ordinary telegraphy by means of instruments called "relays."

Before passing on to the consideration in detail of Marconi's system I would like to show you a diagram on the screen of Preece's system. It will be interesting to many of you who are in the habit of following out electrical diagrams, to observe the method adopted by Mr. Preece to secure the desiderata above-mentioned, viz.: great suddenness (see Plate I) in the making and breaking of as large a current as possible. The diagram (Plate I) shows that on both sides of the channel to be crossed, the ordinary "Morse Key" circuit is made. The current interruptions are produced by a commutator driven by a small auxiliary motor. The suddenness of the break is increased, and the sparking reduced by a condensor placed across the commutator terminals. I suppose at Oban the

length of this wire was about three miles, and each end was connected to earth plates. Exactly similar circuits being arranged on both sides of the channel, a buzzing in the telephone at the distant station is produced as long as the Morse key at the near station is kept depressed. Hence signals can be exchanged between the two stations by the Morse code at about the same speed as ordinary telegraph signals.

PLATE I.

(Adapted from diagram shewn at Mr. Preece's R.I. Lecture).



Mr. Preece says that for good effect it is necessary to erect parallel overhead wires of similar length to the distance to be crossed on each side of the channel. You will remember that I told you that in this system you really need more wire than is necessary for connecting directly. For good effect you require as much wire on the one side of the channel as you have on the other, and parallel to it. When earth returns are

used in each circuit it is necessary to stretch the wires as much as possible above the surface of the ground. Some of the disadvantages of the system will at once be obvious. (1) The extreme weakness of the signals renders it impracticable to call attention. It is impossible for an operator at a distant station to know that a message is being sent unless he has his ear perpetually at the telephone. (2) The system is only possible when two parallel wires of considerable length can be stretched at some height on either side of the channel to be crossed. This renders it impossible on a lightship or rock lighthouse. There are many small islands for example where it cannot be done. On the other hand when signals are successfully transmitted they are very clear and very easily read, and the signals are not likely to be confused by disturbances from other sources. Marconi signals, on the other hand, are to a certain extent liable to confusion from unforeseen disturbances such as a flash of lightning. I do not know whether the Marconi system has ever been tried in a thunderstorm, but there appears to be some element of danger from this cause. If a satisfactory form of delicate relay could be devised which would bring in action a local battery, the first and most serious disadvantage of Preece's system, which I spoke of, would be remedied. It is a difficult problem, but I believe not impossible. I am not quite certain whether a certain degree of success has not been attained already, and I think apparatus is now being experimented with which promises success.

I shall now leave Preece's system, which serves fairly well as an introduction to a more recent invention—which I shall call Marconi's system. To sketch the development of what is called Marconi's system is to show how truly cosmopolitan science is. The system really may be said to be the result of the study of one of the oldest phenomena known in electricity, namely, the electric spark.

Forty or fifty years ago it was discovered that a spark from a Leyden jar is under certain conditions oscillatory in character; it consists not of a single discharge from one point to another, but of a series of surgings to and fro, the oscillations continuing until the energy of the discharge is exhausted, the whole discharge occupying, however, only a very small fraction of a second of time. This was probably known to Faraday in England and Henry in America. In 1855 Lord Kelvin gave the mathematical conditions for a spark to be oscillatory. Perhaps the best analogy to give is the release of a stretched spring. When a spring under tension is suddenly released it does not contract to its original dimensions, but vibrates backwards and forwards with a series of oscillations. The instant before the spark leaps across the gaps separating the spheres of the transmitting instrument (shown) on the table, the space between the spheres is in a state of strain. The fact of a spark passing, is the outward and visible sign of the release of this state of strain, and in the same manner as the spring, the electricity surges backwards and forwards with vibrations of ever-diminishing amplitude,

until the discharge is complete. Every sudden discharge then consists of a series of surgings, but with so great a rapidity do they take place, that the whole discharge appears practically instantaneous to the eye.

Shortly after Lord Kelvin's mathematical theory was enunciated, Clerk Maxwell developed his famous theory of the identity of electric waves and light waves, and showed that while an electric oscillation is in progress there must be thrown out at right angles to the line of oscillation—in this instrument (see Plate II.) the line of oscillation in the line joining the centres of the spheres—an electro-magnetic wave which moves with the same velocity as light but is of different wave length and frequency. Seeing that the time occupied by a single one of these oscillations may be less than one hundred millionth part of a second, it may be gathered what difficulties lay in the way of experimentally verifying Clerk Maxwell's theory, and the theory remained for many years little more than a pious belief among the school of mathematical physicists founded by Maxwell, and was doubted by a great many scientists—especially on the Continent. However, it remained for a scientist on the Continent—Hertz in Germany—to set all doubts at rest and to triumphantly vindicate Maxwell's theory; for by a brilliant series of experiments he demonstrated in a conclusive manner the existence of those electro-magnetic radiations; and not only that, but proved that the waves are capable of being reflected, refracted and polarized—they showed, in fact, all the phenomena of light waves.

The fact which enabled Hertz to detect the radiations is this: If a series of electro-magnetic waves, set in motion by electric oscillations, find in their path a conductor or system of conductors, they tend to set up an electric oscillation in the conductor, which will be the more marked if the conductor by reason of its capacity, inductance, and resistance, tends to oscillate electricity with exactly the same frequency as the initial oscillator, in which case the action is called resonance. This action can be illustrated by a very well-known phenomenon connected with sound waves. If anyone strikes a tuning fork in the vicinity of a number of different tuning forks, those forks whose note is the same or a harmonic of the forks struck, will be set vibrating—and again let any one sing a sustained note close to a piano, he will notice that the piano wire tuned to the same note will vibrate as also will its harmonics in a lesser degree.

Similarly with electric vibrations. I do not ask you to believe this statement without showing you something in the nature of an experiment confirming it. I must ask you to accept this fact: When you see a stream of sparks across the spheres of the transmitting apparatus (Plate II.) you must imagine that each spark consists of a number of oscillations taking place perhaps at the rate of about 250,000,000 per second. Each oscillation starts an electro-magnetic wave at right angles to the line of oscillation; the wave moves outwards with the velocity of light, 186,400 miles per second. The wave length is accordingly about

4 feet long. I place here in the path of the waves a conducting system (receiver) similar to that of the transmitter. The receiver consists of two pieces of pointed carbon rod supported by two brass rods. At the other end of the carbon rods two copper "wings" are fixed, the function of which are to tune the receiver, more or less, to the transmitter. A minute gap separates the carbon rods. If the key controlling the

PLATE II.

(Diagram shewn at Mr. Preece's R.I. Lecture).

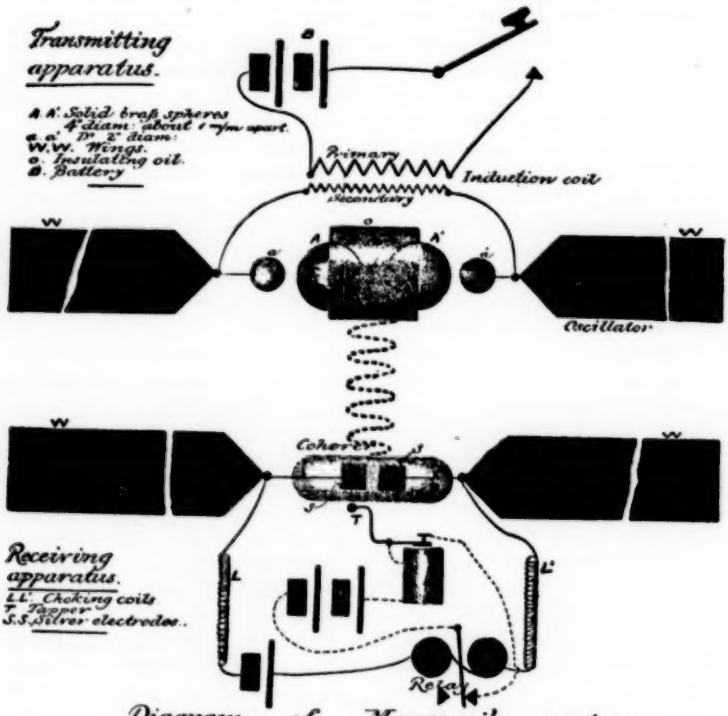


Diagram of Marconi's system.

transmitter be depressed (causing sparks to pass across the transmitter spheres) a series of sparks can be observed to pass across the small gap between the carbon points, although no material connection of any kind exists with the transmitter. (Experiment shown: The fact of the sparks passing confirmed by one of the audience.)

These sparks are visible only by careful and close observation, but in order to make the fact obvious to everyone in the room, I adopt an

expedient to show unmistakably to everyone that the sparks really pass across the gap. I connect to the two sides of the receiver, wires from the dynamo in the base of the building, between which a considerable electrical pressure exists. Nothing will happen until a spark passes, but immediately this occurs the obstruction formed by the air gap "breaks down," and the well-known brilliant electric arc is formed between the carbon points.

(Experiment shown: Wires from dynamo connected one to each side of the receiver gap. On pressing the "transmitter" key a few feet away the electric arc immediately started.)

The assistance of a dynamo is not absolutely necessary to show you all, that electrical oscillations are produced in this receiving apparatus owing to the primary oscillations of the transmitting apparatus. For if I connect a small "vacuum tube" across the gap of the receiver, you will see the tube glow strongly when sparks are caused to take place across the transmitting apparatus.

(Experiment with vacuum tube shown.)

It is not, perhaps, an easy thing at first to grasp, that when electrical oscillations are produced, electro-magnetic (Hertzean) waves are thrown out at right angles to the line of oscillation. These waves in their turn are able to excite similar (but less intense) electrical oscillations in a suitably constructed receiving apparatus at a distance.

These "wave models" may assist you. I am indebted to Professor Sylvanus Thompson for the loan of the large model. It is the model he exhibited at the Royal Institution not long since. The communication of an oscillation from one swinging body to another at a distance becomes beautifully evident, the intermediate mechanism being in the model a long row of leaden balls suspended in a peculiar manner.

Captain Kennedy lent me the smaller model, whose action is similar, though there are in his model one or two ingenious improvements. These are, I believe, the only two models of the kind in existence.

The mechanism that transmits electrical oscillations is invisible to us. "Ether" is the name given to the medium in which the wave motions take place, and there is no doubt that by some transverse undulations in this medium, the electro-magnetic (Hertzean) waves as well as light waves are conveyed. No one knows what the actual "mechanism" of the ether is (if one may use such a term), but knowledge is gradually being gained on the subject.

The experiment just shown you serves very well to indicate the nature of the apparatus required for transmitting signals by means of these Hertzean waves. Besides the transmitting apparatus producing the waves we require a detector of such waves. Moreover the detector will produce a more visible signal of it and serves to bring into action some local source of energy, so that the fact of the arrival of the wave may be demonstrated in a more energetic manner. For instance, the local source of energy in this experiment was a dynamo in the base of the building,

and connected with either side of that gap it served to bring into action the energy developed by the dynamo, and everybody saw the electric arc which it produced.

The wave can be detected by a minute spark only visible by careful observation, or by a vacuum tube; but by far the most sensitive arrangement is the "coherer" to which I now draw your attention. The spark arrangement would perhaps act at about double the distance I have it (about 4 feet) but not further; the distance at which the vacuum tube will perceptibly glow is smaller still; but the coherer is extremely sensitive to these electro-magnetic waves. It consists mainly of a glass tube in which are two silver plugs, separated by a very short distance, the space between them being half filled with metallic filings. This little tube of glass with the metallic filings is the soul of the Marconi apparatus.

In order to explain its action I must make a slight digression. Some time ago the discovery was made that a tube filled with metallic filings in a finely divided state offers a large resistance to the electric current—in fact it is practically a non-conductor. Possibly each particle is surrounded by a film of gas.

Then experimenters after Hertz noticed the curious fact that a tube such as I have described immediately becomes conducting in a greater or less degree when Hertzean waves impinge on it, the drop in resistance depending on the intensity of the radiation falling upon the tube. It was found that this form of detector was extraordinarily sensitive. The simplest way of using such an instrument to detect waves would be to connect a single voltaic cell with a galvanometer in circuit with it. Owing to the high resistance of the coherer little or no deflection is produced on the galvanometer until a wave of sufficient intensity impinges on the coherer. Immediately this occurs the resistance of the coherer drops, and a current flows showing a deflection on the galvanometer.

(Experiment shown: Coherer suspended across the gap of the receiving instrument and placed in simple circuit with a single voltaic cell and galvanometer. Immediately a spark took place across the transmitter, the galvanometer showed a full deflection.)

It will be observed that the "cohesion" remains after the exciting cause is removed, and the galvanometer will show a deflection for an indefinite time, unless the original non-conducting state of the coherer is restored. This can be done by mechanically shaking up the filings with one or two smart taps. The receiver is then in a position to record a second signal.

(Experiment shown: The coherer was tapped and the galvanometer needle again returned to zero.)

You see that the coherer is the soul of the apparatus. Now the problem was to make use of the coherer to give audible signals, and in order to do that, Mr. Marconi had to arrange an automatic method which,

when the signal is over, caused the coherer to be tapped and the signal to cease. What happens in the coherer is a matter of conjecture, but it would appear as if the oscillations induced through the metallic filings cause the films between these fine particles of metal to break down and produces partial welding together or cohesion of the filings—hence the name "coherer," the most apt name that I think could be given to it.

All the facts which I have just mentioned were in possession of the scientific world before Marconi showed that intelligible signals could be sent over distances exceeding one mile. Previous to this the distance signalled was about 40 yards, and the opinion appeared to be held by scientists of the highest repute that half a mile was about the limit. There would appear to be a tendency on the part of some scientists to deny credit to Mr. Marconi on account of these facts being previously known; but it is undoubted that Mr. Marconi was the first to produce apparatus on the above-mentioned lines by which readable signals could be produced over a useful distance, that is more than one mile.

Here I would draw attention to a point frequently lost sight of, that it is a great step from simply detecting waves with this apparatus to making this apparatus record organized signals conveying an intelligible message. The credit for this would appear to be due to Mr. Marconi, thus raising an instrument from the rank of a scientific curiosity to that of a practically useful piece of apparatus.

Let me give you a short description of the Marconi apparatus (see Plate II).

The transmitter is a modification of the pattern devised by Professor Righi. The oscillations are produced across a system of four solid brass spheres. The gap between the two centre spheres is about a millimetre long; the outer gaps are longer and adjustable according to the spark length employed. Connection is made to the secondary of an induction coil capable of giving a spark up to about 10 inches in length. A simple key is inserted in the primary circuit, on pressing which for a short or long period, a stream of sparks of short or long duration may be produced across the spark gaps of the transmitter, thus causing radiation of the waves under definite control. The short and long discharges correspond to the dots and dashes of the Morse code.

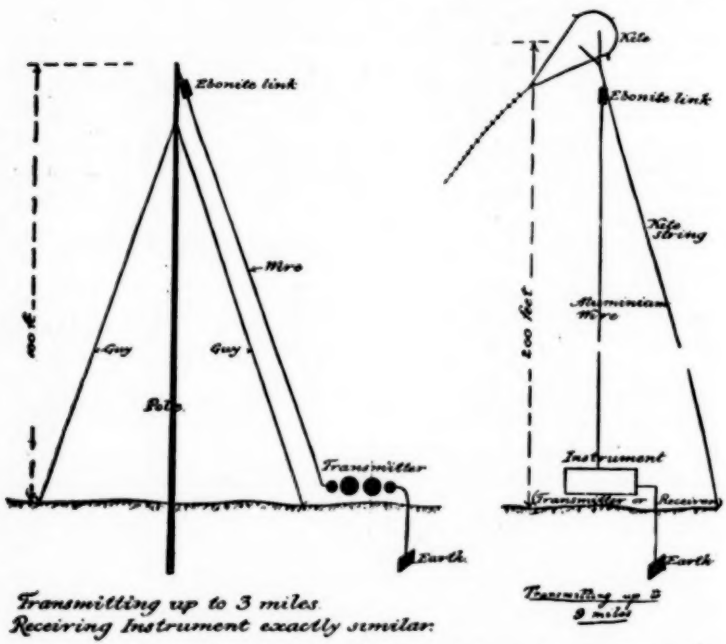
Two points about the transmitter will attract attention. First of all there is the parchment jacket filled with resin or vaseline oil which surrounds one-half of the centre spheres. The main object of the oil bath is to keep the surface of the centre sphere clean and polished. It is essential for the production of this electrical radiation that the spark shall "snap" across very sharply, and to secure this the surfaces between which the spark passes must be kept clean, smooth and highly polished. Secondly the "wings." These are very much in evidence and attract the eye at first more than anything else. As a matter of fact the instruments within this theatre would work probably as well without these wings. Their object may be stated to be: (1) to lengthen the line

along which the oscillations take place, and in consequence to increase the space influenced by the radiation; (2) to impress a definite wave length upon the radiations so that the receiving apparatus provided with similar wings may respond more readily to the influence by the action known as resonance, analogous to the tuning previously mentioned.

This resonance effect is not so essential to the action as was once thought, as the receiver is not very discriminating as regards the exact wave length to which it will respond, but at extreme distances it may be important to tune the receiver to the transmitter. For sending over long distances those wings are done away with. (See Plate III.)

PLATE III.

(From R. E. Journal).



Transmitting up to 3 miles
Receiving Instrument exactly similar.

Transmitting up to 8 miles

In place of the wings one side of both receiving and transmitting apparatus is connected to a vertical wire; the other side to earth. The height of the vertical wire necessary depends on the distance signals are to be sent. A height of 100 feet at each station has been found sufficient for transmitting about 3 miles (using an induction coil, giving about a 6-inch spark). With a vertical height of 200 feet signals were sent a distance of over 8 miles. The diagram (Plate III) shows how a kite was employed to raise the vertical wire. There is no reason why the arrange-

ment should not be simplified by using an aluminum wire as the kite-string, the kite-string would then form the "oscillating line." It is found sometimes that it is unnecessary to "earth" the receiver. The transmitter should, however, be well "earthed" when using the vertical wire.

Some of you may have noticed in the entrance hall, as you entered, a piece of apparatus which was lent me by Captain Kennedy, R. E. It is the Marconi receiving apparatus, but there are certain little mechanical details which do Captain Kennedy a good deal of credit on account of the ingenuity with which they are worked out. I propose to put this apparatus to a very practical test by sending a message to it from the transmitting apparatus on the table. I shall first attach this vertical wire (about ten feet long) to one side of the apparatus, and connect the other side to earth. The receiving apparatus outside has a similar vertical wire, but the earth wire is omitted. The receiving instrument has also connected to it, in "parallel" with the tapper, a "Morse Recorder," an instrument which registers the message sent in dots and dashes upon a running tape. I should be glad if some one would accompany the quartermaster-sergeant outside to see if the instrument is working, and bring in the message recorded.

(Experiment shown: One of the audience went to the receiving instrument outside. A few letters were sent on the Morse code from the transmitting apparatus. The tape with the message recorded was brought back, and handed round for inspection.)

You see that a moderate thickness of brickwork and doors will not prevent the passage of these electrical waves. The message, as you observed, was sent very slowly, but you must remember this apparatus is in its infancy, and infants must learn to walk before they can run.

The principal portion of the receiving apparatus is the coherer. Marconi's coherer (Plate II.) consists of a small glass tube 1½ inches long and about $\frac{1}{10}$ inch internal diameter. In it are tightly fitted two silver plugs whose faces are separated by about $\frac{1}{30}$ inch. The small space between them is half filled with fine metallic filings, chiefly of hard nickel, with a small admixture of silver. The air is exhausted from the tube until a considerable vacuum is produced, and the tube is then sealed. A vacuum is not absolutely necessary, but desirable. In my opinion its object is to insure that the interior of the tube is quite dry. The action of the coherer when oscillations are excited through the tube has been previously described. The terminals of the tube are connected in simple circuit with a single dry cell and a "relay" of Post Office pattern. The current through this simple primary circuit is not sufficient to actuate the relay, until the oscillations are excited. When this occurs, the relay tongue moves over, and establishes a current through a local circuit containing a "tapper," and a comparatively powerful battery. The function of the "tapper" (constructed like an electric trembling bell) is to strike the coherer and bring about mechani-

cal de-coherence, *i. e.*, restitution of the coherer to normal non-conducting state. Therefore as long as waves fall on the coherer the tapper continues to strike it, and the motion of the tapper ceases when the electrical waves cease.

The sound made by the tapper is generally sufficient to enable the signals to be read, but should it be necessary to record the signals, a "Morse inker" is placed in parallel with the tapper and the signals are then registered on a tape according to the Morse code.

In the diagram—(Plate II.) the Morse inker is not shown.

(Experiment: The action of the tapper on a receiving apparatus placed in the theatre was shown.)

To insure successful signalling over any but quite short distances there are a number of details to be attended to which it would be out of place to enter into here, and I think it is time now to give you some idea as to what has been done up to the present.

Mr. Marconi has kindly furnished me with the following statement: At Salisbury good readable signals were transmitted a distance of from 5 to 6 miles during a series of experiments early in the year. More recently he tells me a distance of 8 miles has been covered at the same place. Some experiments were made in signalling across the Bristol Channel near Cardiff. Success was achieved in transmitting signals from Lavernock to Flatholm, 3½ miles, and subsequently from Lavernock to Brean Down, 9 miles. I am, by the kindness of Major Carr, able to show the records of two of the actual signals sent from Lavernock to Flatholm on 13th May, 1897. It will be seen that the messages are perfectly readable by anyone acquainted with the Morse code.

At Spezzia, in Italy, messages have been sent from ship to shore, a distance of 12 miles, and I am told that the Italian government are giving the system a practical trial for naval purposes.

The most recent experiments carried out by the General Post Office have taken place at Dover, but the main object of these appears to have been to discover more precisely the conditions necessary to assure success rather than to work through any record distances. This is the apparatus actually used at Dover.

(Experiment shown: The great sensitiveness of the Dover set was shown by the fact that it could be set in action from the minute oscillations produced by an ordinary trembling bell.)

It is not very well known to most people, perhaps, that when they ring an ordinary electric bell in a house they are setting Hertzean waves in motion. That is, however, a fact; and advantage is taken of it to test the sensitiveness of a Marconi receiving set. I have here a small electric bell and a single cell. You will see that the very feeble electromagnetic waves sent out when the bell is rung will work this sensitive apparatus at a distance of two or three yards.

It has been stated that "weather seems to have no influence, and that rain, fog, snow and wind avail nothing," but in the light of more

recent experiments it would appear that some slight influence is exerted by rain and mist affecting the distance over which transmission is possible; and further that signals may be sent a greater distance across water than across land. Perhaps it would be desirable to add that these last statements are personal impressions formed from experimental results up to date.

I have entered into some detail regarding the apparatus for signalling in both Preece's and Marconi's system, because the nature of the apparatus determines to a great extent the uses to which it can be put.

As to which of these systems is most capable of general application I have little hesitation in expressing my own opinion, that Marconi's shows greater possibilities than the other. The conditions are more elastic. It is not always feasible to run two parallel circuits of considerable length, and as for experimenting with Preece's system it is practically impossible for private individuals who have not a large estate at their disposal or the facilities of the post-office authorities. I may tell you that I have not made any experiments over long distances with Preece's for the reasons I have just given. I have, however, made experiments over a considerable distance with the other system.

The vertical wire has been condemned as the greatest disadvantage of Marconi's system, but to raise a vertical wire is a more feasible and rapid operation than running a long line of elevated insulated wire. In a wind a kite will raise the wire, and in a calm a small balloon might be used. Tall trees, steeples, flag-staffs, towers, or cliffs can be taken advantage of as occasion offers. It appears to me that one of the drawbacks of Marconi's apparatus is the necessity of providing a powerful and efficient battery for working the induction coil. That would perhaps limit its use in the field where one knows what a trouble it is to make up really good and powerful batteries. Secondary batteries are the best. No doubt the fact I have just mentioned would militate a good deal against the employment of this system in the field. Of course dry cells can be used, but dry cells will not last very long and I do not think we have much experience as to how dry cells would stand the rough conditions of service in the field.

When an interchange of messages between two stations is required there must be, of course, a transmitting and a receiving apparatus at each station, and it would appear that your own receiving apparatus would respond to your own signals. Where there are only two stations concerned that is not much disadvantage, but where there are more than one pair of stations established within a short distance of one another, and they are exchanging messages simultaneously, the signals would get hopelessly mixed unless by some process of tuning the receivers can be made to respond only to waves of some selected and adjusted wave length. Mr. Marconi, I believe, claims to have accomplished this, but in what manner I must express my inability to tell you.

When treating of the military possibilities of the system, I must be

allowed to use the term military in a very wide sense. The navy, of course, would be most benefitted. Fully equipped with electrical appliances and provided with a mast as support for the vertical wire, communication of orders from a flagship to ships of the squadron will be facilitated, while it should be possible for ships to receive intelligence from shore, say from a coast-guard station, without the necessity of coming into harbor.

Unless the receivers can be tuned, the use in the presence of the enemy appears to be impracticable as the enemy would probably be able to confuse the signals. Consider also the danger of a false signal being sent, if there was no guarantee as to the source from which it emanated! The use of cypher will get rid of this disadvantage.

Captain Jackson, of the Royal Navy, considers that one useful employment of the system would be for a friendly torpedo boat entering a harbor to announce itself by a preconcerted signal and so prevent its being fired on as an enemy. Those who know the difficulties (in connection with our experiments for coast defense), in distinguishing friend from foe, will see that this is rather an important application. I might add that Captain Jackson has been most actively experimenting with the system in the neighborhood of Devonport.

One most promising field for the employment of the system is in connection with coast defense. Very frequently it happens that communication must be established between the fortifications on both sides of a harbor or estuary. This is usually effected by a submarine cable, but those who have been charged with the duty of maintaining these cables know their liability to be picked up and broken by barges, ships, etc., anchoring or dragging anchors over them. Wireless telegraphy as an alternative would, in such a case, probably maintain communication at a critical time. To give another instance it might be possible for a beleagured garrison, especially on the coast, to establish communication outside. I fancy that many military men, engineers especially, have been getting a little frightened by the statement made in the press that by means of this apparatus the enemy has the chance of blowing up your magazine at a distance without connecting wires to it, or there might be the chance of blowing up the magazine of a ship at a distance. I will tell you at once that it can be done; but it it will perhaps reassure you to know that there would have to be some one—some traitor—who will put this Marconi apparatus into the magazine or into the ship, and it would be so much easier for him to effect his object by striking a match! I can show you that it is possible.

(Experiment shown:—A Marconi apparatus connected to a fuse at the other end of room. On sending the wave, fuse explodes.)

I should tell you that although it would be difficult for an enemy to blow up your own magazine, this last experiment shows the possibility, does it not, of your carrying out a demolition at a distance without running wires. Suppose, for example, you have to prepare for demolition

a bridge, or the outbuildings of a town or village, and your wish is to keep them standing till the last moment, it would be an advantage if you could effect their destruction from some central point at a distance, and destroy them at a given moment.

I must remind you in conclusion that I have been attempting to describe a system which is in process of development. A number of experiments are at present being carried out, the ultimate result of which must be to determine definitely what can, and what can not be done, also to increase the certainty with which signals can be sent, and I must thank you also for the admirable patience you have shown under so heavy a bombardment of electric waves.

DISCUSSION.

Major R. M. B. F. KELLY, R. A.—I have been very much interested in what Captain Brett said as to the military possibilities of this form of telegraphy, especially with reference to keeping up communication between forts on the opposite sides of rivers, which has presented very great difficulties, especially where those rivers are great highways. I am afraid that one of the difficulties in this kind of communication will be the liability to interference either from your own or from other installations, and I should like to ask if there is any possibility of this form of electricity being used in connection with submarine mining and thus get over a great many difficulties which rather interfere with the full development of submarine mining in our present crowded highways and harbors.

Captain BRETT.—As regards the application to submarine mining, I do not think there is much chance of success, but I do not know that it has ever been tried. An attempt has been made to work Preece's system through water in order to communicate to lightships. The two parallel coils of wire were placed, one at the bottom of the sea, the other round the lightship. It was thought that by this means signals could be maintained through the water; but water, especially sea water, is something of an electric conductor, and the energy, radiated was absorbed in the water in the form of "eddy currents," so that very little got on board the lightship at all, in fact it was a failure. If this were the case of oscillations of only 260 a second, it would probably be much more so with oscillations of 260 millions a second. One, of course, never likes to theorize on a thing that has never been tried, but I do not anticipate that there would be any success.

J. GAVEY, Esq., Principal Technical Officer, Telegraphs Department, G. P. O.—Captain Brett has given such an exhaustive and lucid account of both the electro-magnetic and the Marconi systems that I am afraid he has left but little for other speakers to say. However, I have had the honor myself of conducting a large number of experiments on both systems on behalf of the Post Office, and perhaps I may usefully call attention to a few of the practical questions bearing on these methods of sig-

nalling. In reference to Preece's system, I should wish to call attention to one fact which I do not think is generally known, and it is this, that in the course of some experiments which I was carrying out a few years ago on opposite sides of Loch Ness, it occurred to me to replace the ordinary vibrating apparatus which has just been described, by telephones, and on connecting these to each of the parallel wires on opposite sides of the Loch we were able to exchange speech, although the two wires were 1¼ miles apart; not only this but I distinctly heard the shouts of laughter of my colleague on the other side at some puerile joke which I ventured to make. Another point is this: It is said that a length of wire is wanted on each side of the distance to be bridged at least equal to the distance itself, and that in many cases this is impracticable. There is another possibility, although we have not tried it on a large scale, namely, that the parallel wires may be replaced by large coils with numerous turns placed horizontally, and in that manner it would be quite possible to connect telegraphically an islet with the mainland where the islet itself was not of sufficient extent to admit of the necessary length of parallel wire being erected. We might place a number of coils on poles or otherwise, the same arrangement being made on the mainland, and it would be quite possible to establish communication in that way. There is also some hope that we may be able to arrange for a call because, as Captain Brett has pointed out, that is the weak point in the system at present. Mr. Sidney Evershed has designed an extremely ingenious form of relay in which a very fine wire is placed in a very powerful magnetic field, and it is possible by sending a succession of induced currents through this fine wire to cause it to vibrate and thus to close the circuit of an ordinary electric belt. I may add that we are about to establish this system practically in the Bristol Channel, and I daresay in the course of a few months we shall be in a position to give you more information on the subject.

Now turning to Marconi's system, a large number of experiments have been made not only in this but in other countries, and we have now obtained somewhat definite views of the laws which govern this method of transmission. First dealing with vertical wires it has been demonstrated mechanically, and proved practically, that within certain limits the product of the two heights bears a definite relation to the distance over which signals can be obtained. When transmission takes place over land by means of two vertical wires each 50 feet high, a range of one mile is attained, giving a product of 2500 as the square of 50. Within somewhat undefined limits the law of vertical heights holds good and is as follows:

$$h_1 = \sqrt{h^2 \times x}$$

Where h = Height in Feet

x = No. of Miles

h_1 = Height Mercury

To reach distance x:—

Comparing these figures with the published results of the experiments across the British Channel together with others made over inlets of the sea at Spezzia, it should be possible to signal a distance of one mile with wires about 35 to 40 feet in height. The discordance in the two classes of experiments is well marked, and we can only conclude that there is a difference in the transmission of Hertzean waves over land and over water. During the course of some electro-magnetic experiments in the Bristol Channel which were conducted in 1892, we had absolute evidence that the waves were reflected from the surface of the water, and I cannot help thinking that reflection plays a very important part in the long distance experiments over seas and inlets which have been carried out in various places.

Professor Slaby, who has made experiments in Germany, has observed the same difference in transmission over land and water, and he is reported to attribute this to the fact that the atmosphere over water is freer from dust particles than on land. With all deference to such an eminent authority I cannot quite accept this as a full explanation, for two reasons: first, I cannot quite realize how these minute dust particles could have much effect in reflecting long Hertzean waves; and in the second place I do not think there would be much difference in the atmosphere over the downs between Dover and Deal, and that over the water immediately adjoining. One little illustration perhaps may tend to explain how the difference may arise. If you look at the sun or the moon when rather low on the horizon, then when either is shining over intervening land, you see a general illumination and nothing more, but when shining over water you get blinding rays of light reflected from the surface, and it seems very plausible to assume that those Hertzean waves which impinge on the land are either absorbed or may be reflected right away into space, whereas on the relatively smooth surface of the water they are reflected on to the vertical conductors.

Another point which no doubt will be of considerable interest to members of this Institution is how far secresy can be maintained in this method of communication. If you erect a vertical wire and send signals through it, any person who chooses to erect another wire anywhere within the radius over which the signals can be transmitted, and to provide suitable apparatus can read your messages. Now when Mr. Marconi first introduced this system he expressed the opinion that it would be possible by suitably tuning the transmitters and receivers to overcome this difficulty. I fear, however, that with ordinary vertical wires this will be almost impossible, for it is found that instead of using two vertical conductors of the same height two of widely differing dimensions giving the same product are used and equally good signals are obtained. On looking at the question theoretically there appears to be no reason to expect a different result. Captain Brett explained how a series of surgings were set up on making contact between the induction coil and the transmitter. Now the apparatus that gives the largest

number of surgings for each single original impulse consists chiefly of a Leyden jar with two short wires separated by an air gap to complete the circuit. It has been calculated that in a system of this kind, for one impulse of the coil there are thirty or forty surgings in the oscillator. If another Leyden jar similarly fitted be placed in the neighborhood of and within two or three feet of the former, and the two be carefully tuned, then on exciting the first or oscillator an overflow discharge is observed in the second or resonator. For this purpose tuning is absolutely imperative. With an oscillator of the Righi type fitted with short horizontal wings, it is generally considered that only three or four surgings occur for each original impulse. Now with the three or four surgings it is still necessary to tune in order to transmit over the longest possible distance, but for shorter ranges, signals can be received even if the two circuits are not in tune. When a long vertical wire, however, is used there is every reason to believe that the surgings are reduced to one oscillation. Now if we consider the effect of resonance say on two stretched wires or strings, when one is put in continuous vibration, each vibration emits an impulse which is propagated through the air on to the second wire, and when the two are in unison these impulses are cumulative in their effect so that the latter responds to and repeats the original one. If, however, the two wires are not in tune the tendency of some impulses to increase the swing of the secondary wire is checked by subsequent ones in the opposite phase, and either the secondary gives no note at all, or perhaps an intermittent and irregular one. If, however, it were arranged that one single excursion or vibration only were imparted to the primary string that impulse would be conveyed through the air and would affect any other string irrespective of its length, and I think that action takes place when vertical wires are used for Hertzean radiation, because whether the oscillation and resonator are absolutely in tune or not—you can always get the latter to respond to the former. Therefore it seems to me quite hopeless to expect to get secresy by mere tuning when working with a system of vertical wires alone. There is another little point which goes to prove that resonance does not come in. It is found that the Righi apparatus, which has hitherto been considered the best form of radiator for moderate distances, presents no particular advantage when connected to a long vertical wire. With sufficient energy at command it is only necessary to fix small spheres on the discharging rods of the coil, for practically the radiator in this case consists primarily if not solely of the vertical wire. There is, however, one exception to this rule. If a capacity consisting of several square feet of plate copper be fixed at the upper ends of the vertical conductor, tuning becomes more effective, and to obtain the best results regard must be paid to this.

There is another point of considerable interest. Although it is necessary to have the earth connected to the radiator to obtain the best results, yet when the receiving apparatus is adjusted to record good signals, the

disconnection of the earth and the substitution of a capacity consisting of a couple of feet of brass strips an inch wide sufficed to maintain communication. In other words the earth is almost unnecessary for receiving, and the electrical surging takes place simply from the vertical wire on one side through the coherer to the capacity on the other side.

Reference has been made to lightning. That is a point that requires considerable care when making experiments with very long wires. If you erect and insulate a vertical wire in ordinary fine weather and let it remain idle for a few seconds it accumulates a charge which is quite sufficient to give you a sharp prick when you touch it, and which is sufficient to actuate the coherer so that when atmospheric disturbances are rife, false signals are frequently received. It would always be wise in using very long wires to put a shunt of somewhat high resistance and self-induction between the receiving wire and the earth so that it may carry off all disturbing charges. By disturbing charges I mean minor ones that would be likely to interfere with the reception of signals, because inductive lightning effects would probably pass through the shunt coil to earth, whereas the rapid oscillations due to induction would pass through the coherer. For heavy discharges, however, further precautions are needed, and it would be wise whenever using lofty conductors to provide a good lightning protector of the type used for telegraph instruments.

By the way, in connection with the question of the law of distance I should perhaps have pointed out that this law does not hold good over an indefinite distance. This is due to various causes. The extra distributed capacity of a very long wire must materially slow down the rate of oscillation. Again the rotundity of the earth cuts down the useful length of the conductor whilst probably reflection and absorption come into play, but it is without question that the law would not hold good, say for thirty or forty miles. In connection with certain experiments made by Mr. Marconi, aided by Captain Kennedy, between Salisbury plain and Bath, a distance of some forty miles, they raised wires into the air by means of kites to a height variously estimated as between 800 feet and 800 yards. Even if it had been only 800 feet that ought to have sufficed for communicating a distance of 520 miles if the law had held good, whereas as a matter of fact they did not get satisfactory signals at a distance of forty miles. It may therefore be taken that the law would only hold good within very limited distances.

Captain BRETT.—I am very glad that Mr. Gavey has given us these details, especially as some of them were (I thought) confidential in their nature. The experimental conclusions regarding the law of distance are most interesting. I did not know that telephoning had been successfully accomplished with Preece's system; that is a very important advantage attaching to it, and one which, if I had known, I would have introduced in the lecture.

DIRECT AND INDIRECT FIRE.

By Major J. L. KEIR, R. A.

(*From Journal Royal Artillery Institution.*)

BEFORE proceeding to a consideration of these two kinds of fire it will be as well to make clear the following:

(1) That indirect fire is not advocated as a rival but as an auxiliary to direct fire, only to be employed when attendant circumstances (such as ground, natural or artificial screens, the nature of the fight) render its use clearly advantageous.

(2) The circumstances under which indirect fire is advocated.

(3) The kind of indirect fire it is proposed to use and the method proposed for its employment.

(1) That in order to gain decisive results you must eventually come to close quarters goes without saying and, when this becomes necessary, all thoughts of personal safety cease. The decisive moment of the action has arrived. It is either win or lose.

Before, however, close quarters are reached, both attacker and defender will make every possible use of the ground to turn it to their own advantage. The object of the former being to reach decisive ranges with as little loss as possible and with the *morale* of his troops unimpaired; that of the latter to delay the attacker's advance and to conceal his own dispositions for defense. So long, therefore, as is compatible with good effect, cover will be utilized by all arms in the earlier stages of the fight and indirect fire will be of importance to the artillery. In the later stages, owing to the general confusion, guns will have many opportunities of advancing to close quarters unobserved and, rapidity and effect being of first importance, direct fire will be the rule.

Such being the general outlines of the attacker's and defender's aims we shall endeavor to foresee how the action of the guns will support them.

(2) The circumstances under which indirect fire is advocated.

It will seldom happen that the defender selects a position against which the entire artillery of the attack can be massed under cover within range of him, and therefore, the mass from which the preparation for the attack is made will, as a rule, have to be more or less in the open. In a long line, however, certain features of ground will always occur which should be taken advantage of as a means of cover and indirect fire made use of.

And when we consider that the normal frontage allotted to the infantry portion of a division of our army is about one mile and that the divisional artillery in line only occupies about 350 yards; on ordinary

ground there should be no difficulty in finding cover for the whole, or a very large portion, within suitable range of the enemy. But when we come to deal with a longer line of guns (15 to 20 batteries), if the line is to be continuous and distances are to be preserved, cover must give way and direct fire only can be used.

Different, however, is the case of the advanced guard batteries, for here cover for one or two batteries only has to be obtained, and reconnaissance of the enemy's position, rather than the pushing home of a determined attack, is the tactical object. The rôle of the batteries will, therefore, be to discover the strength and position of the hostile artillery, without allowing themselves to be seriously engaged, until the intentions of the G. O. C. force are known and cover will therefore be utilized when available.

In the same manner rear guards, two of whose main functions are (1) ability to deceive the enemy as to strength and, (2) having done so, to withdraw from their positions with as little loss as possible, will be much better served by guns posted behind cover, where they can show as much or as little of their strength as they wish and who can hold on till the last moment without exposing their teams to destruction, than by those posted in the open and in full view, where the number of guns can be plainly counted and the exact moment of their retirement is unmistakable.

With how much more effect can all these be carried out if the guns can be brought into position unobserved and their fire only delivered at the moment when the infantry are ready to advance to the attack, or the cavalry to charge and take advantage of the surprise and confusion caused by the opening of the guns from an unknown quarter.

The posting of guns in well concealed positions, aided by natural or artificial screens, where the exact localization of them will greatly enhance the difficulties of the attacker, will, it is contended, be one of the tests of a skilful artillery commander. But in order to turn the situation to the greatest advantage he must have under his command commanders accustomed to rapidly select and occupy advantageous ground and batteries thoroughly trained and practised in the conduct of indirect fire.

(3) The kind of indirect fire it is proposed to use and the method proposed for its employment.

In the hand-book of the 12-pr. B.L. two methods are explained under the heading of "Aiming Posts." In one of which only (the second) is the method of bringing the battery into action described. In the description of the first method four cases are named, the first two of which imply that the battery has come into action in full view of the enemy and no mention is made of a method of bringing the battery into action under cover, for the last two (*i.e.*, when target can be seen on a limber, or mounted in rear of a gun). In fact, it is evidently intended that the battery should be in action before the aiming posts are used, as

the command "stand fast" is the first order given. But even if the battery had been originally brought up under cover its position would soon be indicated by the six men running about 50 yards in front of it to plant their aiming posts as directed.

Now, although considerable accuracy can be obtained by the use of two aiming posts this method is open to many objections and would, as a rule, entail a too great separation of the battery C. O. from his command, unless he trusted entirely to an observer. In short, it is very doubtful whether, as used at present, it would be of much use to horse or field artillery.

The method advocated and described below is a modification of, and is based on, that employed on the Continent.

The battery C. O. having carefully examined the position and decided exactly where he will place his battery (from under cover), brings it into the covered position in rear. He then falls out the sectional commanders and Nos. 1, and the whole advance until they can just see the object over the crest when mounted. Having pointed it out to them all, he orders them to extend from the flank or centre, keeping well under cover, each taking up a position from which he can just see the object over the crest. When all have done this the C. O. dresses them. The Nos. 1 then turn their horses about, so as to face the battery, which is advanced at a walk (to avoid dust), each gun halting with the leaders heads 6 inches from its No. 1's horse. When all are in position the C. O. orders "Action Front," and the guns are run up to positions of the Nos. 1 (10 or 12 yards) by hand. The No. 1 of each gun next mounts on to the gun and stands with one foot on each axletree box, directing it on to the object. As soon as he has directed it the layer looking over the sights from the front, directs No. 5 to plant an aiming post in rear of the gun and 2 and 3 mark the wheels.* Each section as soon as ready reports to the C. O. who, when he has received all those reports, gives the required elevation and proceeds to range from a position in which he can see the target and observe the effect of his fire.

This method is only advocated at ranges over 1800 yards.

Two objections to the above may be urged: (1) Its inaccuracy; (2) the difficulty of obtaining the angle of sight.

We shall now proceed to deal with these objections.

(1) Place a man to act as target, in front of a gun, with a feature of ground in between them, so that the man can only be seen from the gun by the No. 1 standing on the axletree seats. Let the gun be carefully directed on to the man and its position fixed in the usual way by a picket in rear. After two or three rounds (in which the gun is run up or back, half a turn of the wheel each time) give "Stand Fast," let the gun be laid on the post in rear and order the man in front of the gun (the target) to place his helmet on the top of a long stick and raise it up

*N. B. Wooden stops with an iron pin are very useful for this purpose, and add much to the accuracy of fire.

so that a layer looking over the sights in the ordinary way can see it. A little practice will prove that very fair accuracy for direction can be obtained by this method, elevation being given by clinometer. For the following reasons great accuracy of direction is not considered necessary. The modern targets for artillery are (1) Artillery in action, (2) Infantry in long thin lines. In the former case, long distance, or artificial concealment, will very frequently preclude fire upon single guns. In the latter a slight lateral deviation is of small importance, elevation being the chief desideratum. Cavalry will be dealt with under the head of moving targets later on.

(2) As a rule this would be small and the actual range would be given by the range-finders. Thus suppose the range by clinometer elevation was found to be 4° 30′ and the range-finders gave 2500 yards. (3° 5′), as the range. The trial fuse would be bored at 12½ (Mark II carriage). The angle of sight in this case being + 40′ or 4° 30′—3° 50′. Supposing no range-finders available, the angle of sight must be judged, or taken by a pocket level. Practice, however, would soon remove this difficulty.

It is now proposed to deal with the main objections which have been made to an extensive use of fire from behind cover. They are as follows:

(1) It is very rare to find ground where you can carry on practice with more than a single battery.

(2) That you cannot change your target without making elaborate preparations.

(3) That you cannot concentrate your fire.

(4) That you cannot fire on moving targets at all

(5) The ground of moral effect, viz., that an extensive use of cover will make our artillery slow in advancing to the support of the infantry attack.

That it is rare to find ground where you can carry on practice from behind cover with more than a single battery in the parts of England in which military operations are allowed to take place, is admitted. But the great battle-fields of 1870, which may be taken as an average sample of continental country, show ground where large numbers of guns could be fought from behind cover and were our own manœuvres not confined to certain localities, such ground is common enough at home. It may also be taken for granted that the sites of battles are but rarely to be found on level plains where cover for one or both sides is not plentiful. Considering then the enormous extent of modern battle-fields, with their great variety of choice of artillery positions, this objection can hardly be upheld; although it may sometimes become a question whether it will not be advantageous to decrease the interval between guns, in order to obtain concealment for a greater number.

This is, no doubt, a serious disadvantage on the practice ground, where changes of target are of necessity frequent and no enemy has to

be considered; but on the battle-field where your action is to a great extent dependent on the adversary with whom you are engaged it would, even if the case, be much less felt. Are elaborate arrangements however necessary?

Let us first consider broadly when changes of target would probably be found necessary.

In the attack, the defensive position of the enemy having been reconnoitred and his advanced troops driven back on it, the preparation for the infantry attack is proceeded with and few changes of target are necessary, until the advance of the infantry attack masks the guns, which must then advance to a closer range to support it. At this stage, the defender's attention being fully occupied, opportunities for the guns to advance may be expected to be frequent and rapidity of movement and prompt support to the weaker portions of the line of attack will be all important; and here it is hardly necessary to observe the direct method only, except in very exceptional circumstances, will be possible, or indeed advisable.

In the defense, the guns will be so posted as to command the avenues of approach and one great object of the defender being to conceal the position of his batteries, cover whenever practicable will be made use of. As the attacker advances changes of target will certainly be necessary; but not frequent. In this respect manœuvres are most misleading, as the time necessary for the guns to accomplish their object is seldom allowed for and the advance of the attack is rapid and uninterrupted. The duration of battles prove that this is not the case in practice.

The question of cavalry attacks upon guns has not been taken into account, as it is contended that the opportunities for this arm will, as a rule, occur in the later stages of the fight when direct fire is employed.

When two aiming posts are used the arrangements for making a change of target may be considered elaborate; not so however, we venture to think, when only one is made use of. All that is required in the latter case being for the No. 1 to mount on the carriage and re-direct the gun while the layer readjusts the back post. By this method the same latitude of field of fire is open to a battery using aiming posts and forming one of a number in a line of guns, as to a battery using the direct method; for neither can make a change of front without impeding the fire of the batteries on either or both sides of it.

Concentration is a comparative term. A battery, for instance, might concentrate on a particular gun or section of another battery; a brigade division on a particular battery; the artillery of an army corps on a particular locality (village, wood, etc.). In none of these cases is the difficulty much greater when using the method of indirect fire advocated than when firing direct; especially when we consider that smoke, rain, haze or snow may compel a change from the tangent or Scott sight to the clinometer and aiming posts. But will concentration on particular guns or batteries be very easy?

Judging from the latest reports from the Continent, the Germans, at any rate, do not intend to expose their guns, unless obliged to do so. In support of which view I quote from a letter sent to me by an officer who attended their manœuvres last autumn, in which he says :

"The artillery always obtained cover from view when coming into action ; if possible behind bushes and fir trees, but otherwise on the reverse slopes of the hills. I constantly saw the guns run up 120 yards with drag-ropes. The slopes were very gentle and laying with clinometer and aiming posts was constantly resorted to. The country was an open heath and not in general favorable for artillery. I saw a division and the army corps attack a masked enemy and on each occasion the guns were massed on the flank from which the infantry commenced the turning movement. They never changed position, the range being about 2500 yards. When the attack was imminent a heavy fire was poured on the reserves."

They also make use of a disappearing target for the purpose of training their layers to lay quickly on the flash of guns, whose exact position is only visible when firing.

Two translations have recently appeared in the "Proceedings." One, "New Russian regulations regarding the tactical and fire discipline of the brigade division," by Lieutenant H. W. Taylor, R. H. A.; the other, "Ammunition supply in the field" (*Russian Artillery Journal*) by Major E. A. Lambart, R. A. In the former of these the following passages occur :

"(17) It is now-a-days most important, not only to make the reconnaissance of the first position under cover, but to advance under cover and eventually place the batteries on covered positions. The assailant must neglect nothing which may further increase the advantages inherent to the defenders, a delay in opening fire resulting from caution can not be weighed in the balance with the evils resulting from coming precipitously into action."

Particular attention must be paid to the following points :

"(1) Advancing the batteries, each one in formation and to the point most likely to keep it under cover, not hesitating for this purpose to make necessary *détours*.

* * * * * *

"(24) As far as the ground will allow, guns are run back by hand before limbering up, so as to conceal this operation as far as possible from the enemy."

Turning to the second one we read :

"The power of firing from behind crests of hills—a result of improved material—will oblige both sides to take advantage of cover and the zone of ground it will be necessary to search with fire may be very deep, so that to produce the same effect a much larger number of rounds will be required than might be inferred from practice made against visible targets on the practice ground.

"This heavy expenditure of ammunition will take place at the very beginning of a battle and in a very short time. It is true that four or five well-ranged rounds may disable an enemy's battery, but to arrive at these ranged rounds it may be necessary to fire 20 or 30 rounds if the enemy has taken proper advantage of cover.

* * * * * *

"The large increase in the number of intrenching tools carried has given also increased facility to the infantry in taking cover and the power of shrapnel against even slight intrenchments has not increased much since 1870. Troops of all arms moreover have gained great skill in taking advantage of cover."

The conclusion to be arrived at from the foregoing seems to be, that concentration of fire on particular portions of an enemy's line of guns, however desirable, will in future be attended by much greater difficulties than formerly.

Before explaining the method proposed to adopt in firing at moving targets from behind cover, we shall start with the following postulates:

(1) Against rapidly (faster than trot) moving cavalry, little effect is produced at long or medium ranges by the regulation method of ranging and it is better to trust to magazine fire and case at close ranges to repel an attack of this kind.

(2) The consideration of compact bodies of troops moving across the front of a position, in full view and at a uniform pace, is almost unnecessary with the present formations of infantry; and therefore, this description of moving target will not have to be dealt with.

(3) The normal moving targets (omitting cavalry dealt with in 1) of the present time are:

(*a*) Lines of infantry in rank entire, extending over the whole front, which do not make a continuous advance in one line, but by a series of rapid independent advances of numerous small bodies endeavor to establish themselves in a thick firing line, at from 500 to 600 yards of the position to be assaulted.

(*b*) Batteries or brigade divisions, rapidly advancing direct on the position attacked against which better results would, as a rule, be obtained by attacking them at the moment they are coming into action and before they can range, than by treating them as moving targets.

(4) The regulation method assumes that the attacker will advance over a level plain and be visible during the whole advance. This will, it is contended, be the exception, not the rule.

To sum up in one general creed. The moving target, though most useful as an exercise at the practice camp, will rarely be able to be practised in its entirety on the manœuvre ground.

Having had opportunities of hearing the opinions of officers of other branches of the service on witnessing our practice at moving targets, supposed to represent cavalry and infantry, it must be confessed that they were anything but flattering to the imaginary leaders of their

respective arms with regard to their methods of attacking our batteries. We are often so pleased with the doings of our own particular arm that we are inclined to forget the saying of a great general, that in the consideration of an enemy's probable movements we should always give him credit for doing something sensible. Will cavalry attack a well posted and otherwise unmolested battery over a mile of clear and open ground, by a purely frontal attack, after having given it time to pick up the range? The exercise is a useful one for our practice grounds. To hope for such chances in war, in anything but very exceptional circumstances, from an arm whose first teaching is to await favorable opportunities and seize them with suddenness and rapidity is to place too much reliance on the indifferent handling of our opponent's forces.

Should, however, these views not be accepted, it is proposed to demonstrate that the moving target as practised by direct fire on the practice ground can be also performed from under cover.

The chief difficulties in our path are (1) the angle of sight (in this case a constant as we are treating an advance over a level plain). (2) the management of rapid variations of fuse.

This can be found in three ways:

(1) By the range-finder (*i. e.*, difference between clinometer elevation and elevation due to range in degrees and minutes).

(2) By means of an Abney's level or other instrument.

(3) Judged approximately by constant practice. As we are at present dealing with a level plain (the sands at Shoeburyness, for instance) the angle of sight need not be considered.

Taking the 12-pr. gun with Mark II. carriage the following rule for finding the length of fuse required for a certain elevation will be found near enough.

1° = 3 + 1 = 4	lengths of fuse	)	or generally
2° = 6 + 1 = 7	" "		1° = 3 lengths of fuse.
3° = 9 + 1 = 10	" "	}	20′ = 1 length of fuse.
4° = 12 + 1 = 13	" "		10′ = ½ " "
5° = 15 + 1 = 16	" "	)	5′ = ¼ " "

By means of this rule the length of fuse for any elevation can be found at once. Example: 2° 28′, 2° = 7 and 28 = 1½; 7 + 1½ = 8½. The scale shows 9. So deducting ½ we have 8½.

Take another example: 3° 40′ = 12. Scale shows 12¼, which is near enough for a moving target.

Again, between 1100 and 2300 yards 12′ elevation means 100 yards ∴ 24′ = 200 and 30′ = 250 yards.

Instead of dropping 200 yards for an infantry target we shall drop 250 yards or 30′. Commencing with the target at 3° 40′ range drop 30′. The ranging section fires at 3° 10′ and the others 3°, 2° 55′, 2° 50′, fuses 10, 9¼, 9½ and so on, the next drop being ranging section 2° 40′; shrapnel sections 2.30, 2.25, 2.20; fuses 8½, 8¼, 8.

That practice at moving targets, such as are supplied at our practice

camps, could not be carried out when a battery is entirely under cover is admitted, but it is urged that a 6-foot target does not at all represent the real targets we should have to attack. A target extending over a front of 200 or 300 yards could however quite well be dealt with.

Any great difference of level between the battery and the target would bring in the difficulty of the angle of sight which could not, without the use of a compensating scale, be allowed for when using the regulation method and this, though possible, would be much too complicated.

To the lay mind the solution of the cover question seems quite simple. "You will, of course, train your men in peace to do without cover. In war time they will find it soon enough of their own accord."

Were the operation of posting guns behind cover as simple as it sounds, this reply would be quite satisfactory, but as the art of selecting suitable covered positions and quickly placing batteries in them, requires great experience and the science of successful gunnery from behind cover much practice, the solution is, we hold, anything but satisfactory.

We are not afraid to teach our infantry to shoot with rifles for fear, lest, when the time to charge with the bayonet came, they should remain behind under cover. Their officers, having decided the opportune moment to advance, issue their orders and the charge is carried out. Are not our officers capable of deciding when cover should be used and when it should not be used, when to advance and when to remain behind cover?

Moreover, of all arms the one least liable to panic and moral effect is the artillery; not from any superiority in gunners, but from the fact that guns once in action cannot be moved without an advance on the part of the limbers, whereas the tendency in case of panic would be in the other direction. The guns must remain and the only chance for the gunners is to remain with them.

Similarly in advancing, a man, or even a man and a horse, left to their own devices may turn tail; when, however, you have a clump of five men and six horses inseparably connected and all under the eye of a N. C. O., whatever backward inclination one or two of them may have, the majority will carry them forward. This being so, artillery is more in hand and easier to control than either cavalry or infantry. Why then should its commanders not be allowed the same privileges as those of the other arms?

Much as we may despise cover and prefer a bold offensive, is there not a chance that by over encouragement of direct fire we may run the risk of suffering great losses at the outset of a campaign and so seriously impairing that *morale* which we are so anxious to preserve. Important as it is for guns to be well forward, the artillery is only an auxiliary arm whose most important duty is to render the greatest assistance possible to the infantry, who can alone win battles. This would appear to

be best achieved by a skilful use of the arm at the longer ranges, so as to insure its coöperation at the decisive ones.

At manœuvres it is not possible to carry out with any approach to reality the final phases of a battle and the fact that, when two forces are closely engaged opportunities for the advance of guns to close range must occur, cannot be allowed for. Their action, however, during the opening phases of a battle can be foreseen with much greater certainty and practised accordingly.

Excellent as is the experience of the practice ground, the absence of the other arms and the very limited field of its operations render its tactical teachings often misleading. It is to the manœuvre ground that we must look for our most valuable lessons, where we take our place with the other arms and can study their methods in full view, not in imagination.

To sum up, then, the above objections are met as follows :

(1) Taking a large extent of average country and not restricting ourselves to a few limited localities, it is not admitted that it is very rare to find ground where you can carry on practice with more than a single battery. The difficulty caused by the necessity of hitting the " butt " at practice very much narrows the already limited number of positions and it seems often to be forgotten that whereas great care has to be taken to avoid damage by stray shots in peace, these are of no account in time of war.

(2) With practice, changes of target can be made as rapidly from behind cover as by the direct method. With regard to the frequency of these changes, the impressions of the practice ground tend to exaggerate the requirements of actual warefare.

(3) If by concentration is meant the focussing of the fire of a number of guns on a target a few yards wide, indirect fire certainly falls short in accuracy compared with direct, but as such a concentration is only possible for a very limited number of guns, it is maintained that concentration of fire for practical purposes is as attainable by indirect as by direct fire. The facility of concentration of fire is moreover overestimated owing to the necessary visibility given to the targets used for instructional purposes.

(4) The conditions under which the practice of firing on moving targets is at present carried out presupposes a much too favorable position for the artillery. The method is rarely or ever employed by single batteries even at manœuvres. It is never practised by units larger than batteries at all ; and beyond a useful exercise at practice camps, it is of little real value. But even if its ability be granted, with practice and ingenuity the service system could be adapted so as to render its employment under certain conditions by guns behind cover, or partial cover, almost as effective.

To avoid misunderstanding the above remarks are in no way intended to reflect on our present excellent system of training, but to raise the question, whether the deductions of the practice camp, rather than

those of the manœuvre ground, are to be taken as a guide in the solution of questions of artillery tactics similar to the one now under consideration.

(5) If it is to be arbitrarily decided that direct fire, and no other, is to be used it is maintained we shall lose its efficiency and relieve battery commanders from incurring the responsibility of making use of favorable opportunities for placing their commands in concealed positions and fire from behind cover will never be attempted; whereas a modification which allows and encourages a choice of the nature of fire to be made use of, will tend to a solution of the question, when cover should be used and when it should not. Unless, however, the effect of fire with the clinometer from behind cover is tested in comparison with direct fire, no confidence in its use will be established.

There is one other point of view from which this question should be regarded, viz., that of savage and semi-savage warfare. In this, experience of the tactics of the enemy can alone decide the action of the guns, and no form of procedure can be even outlined to suit every case. Their artillery, if any, will be vastly inferior to our own. Effect is first and the rest nowhere.

No special reference has been made to smokeless powder as its use is taken as a matter of course.

The chief points then we venture to submit for consideration are:—

(1) The increased importance of cover and indirect fire for guns demand more frequent practice in taking up positions behind cover and concealment from view of the enemy.

(2) The study of methods of attack of positions on which the positions of guns will not be clearly indicated.

(3) A solution of the questions whether the fire of guns laid from above the gun, with one aiming post behind, is sufficiently accurate, or whether two aiming posts must always be employed.

(4) The issue of clear and detailed instructions for a uniform method of the occupation of positions behind cover, so as to disclose the posture of the guns as little as possible and to settle to what extent it will be necessary to run up guns into position by hand in order to avoid casualties among the horses.

During the last ten years our artillery have passed through several vicissitudes with regard to the best method of coming into action. It commenced with the direct method with no method, followed by the deliberate method with too much method and practically used on all occasions and at all ranges, and ended with the present excellent combination of the direct and deliberate methods. To this it is hoped will in time be added a suitable method of coming into action and opening fire in such a manner as to conceal the movement entirely from the enemy.

Lastly, one thing above all must be remembered—the greatest enemies to the supporters of cover are those who would subordinate effect to cover on all occasions.

RUSSIA IN ASIA.

By Major C. E. de la Poer Beresford, Wiltshire Regiment.

(*From the United Service Magazine.*)

In endeavoring to ascertain what the future holds in store for us in the cradle of our race, we have to consider the four Asiatic Powers, China, Russia, Great Britain, and Turkey. It is true that France holds a considerable place on the shores of the Pacific, and her powerful navy may exercise much influence in the extreme East; but as at present she is likely to follow the policy of Russia in those latitudes, and even to assist the great northern power, her aims may be, for the purposes of this article, considered as identical with those of Russia.

It is the bear, the unwieldy dragon, and the lion, to use a favorite zoological simile, that stretch their claws over Asia. The first and the last are more or less driven by the force of circumstances to extend their territory; the dragon, eminently Asiatic in its delay and inertia, is not likely to yield its possessions without a struggle. Yet it is powerless to oppose united action on the part of the other two, and is probably destined to collapse, or at all events to be shorn of much of its power in the not far distant scramble which seems probable in the extreme Orient. The influence of Turkey is yet very powerful in Asia. The conflict which we are now carrying on from the Hindu Kush to the Suleiman range, is fomented by the influence of Turkish victories; and there are not wanting signs of unrest on both shores of the Caspian, in Russian territory, which may possibly cause similar trouble to the Christians there. The obligations we are under as rulers of seventy millions of Mohammedans, cause considerable modifications in our policy, and are perhaps not sufficiently considered by many, who would wish to see more decided action in dealing with the government of Turkey. It is perfectly well-known to the world at large that Great Britain does not desire further extension of territory in Asia, nor does she require at present other naval stations in far eastern waters. Possible developments of sea power may alter her policy there, but to endeavor to pierce the secrets of the future in this question would now be premature. What the world is not so certain of is the attitude of Russia towards China, nor how much of the central flowery land it may suit her convenience, or her necessity to obtain possession of. We in that question may or may not be a disinterested party. But what we are much more concerned in, are the views which Russia entertains regarding Turkestan, and the territories south of the Hindu Kush and Himalayan ranges; in a word, India.

Our policy with regard to Russia in the past has been characterized

more by emotion than by sound sense. We have failed to allow what we must have well known in our hearts to be the case; viz., that the advance of a European power in Asia cannot always be restrained within the limits originally intended. We have at times cried out with much fervor against the forward march of Russia, and done no more than cry out; forgetting that her rule in Turkestan was infinitely preferable to that of the barbarous and disgustingly cruel Khans and Emirs she displaced. And at the same time we have added enormously to the territory of our Indian Empire on its eastern side, where, after all, we had nothing to fear from Russia. But since those days a wiser and a better policy, advocated by soldiers and statesmen whose knowledge of the Indian question is profound, has prevailed. We have set our military house in order, we have made our military frontier strategically sound; and we can afford to look at the progress of events in Asia with the calm dignity which is possible only to conscious power. It is not the fact, as some in England seem to think, that Russia and her people are animated by an insensate dislike to us and our policy. It cannot but be apparent that in the highest places in Russia, the utmost goodwill towards England and love of peace prevail. In financial circles it must be well known that nothing is so much required by Russia as peace, and time for social and economical development. And in military circles, although doubtless the hand of the central government may be forced by rash seekers after military glory on the frontier, it seems, according to the views of some of the most experienced military men in Europe, that the present time is not considered favorable by Russians for enterprise towards Afghanistan. In all policy expediency rather than sentiment is the wise directing influence; and if it can be shown that it is inexpedient for Russia to attack India, we shall probably be safer in judging such an attack improbable, than in trusting to her goodwill to ward it from us. In a word, the position which we hold as one of two continental powers with long almost coterminous frontiers, makes it necessary to watch the situation with unrelaxed vigilance; whilst abstaining from all provocation or needless offense in words or deed, The greatest of all earthly blessings is peace, and the best way of insuring peace is to be prepared for war. In a military sense it is imperative to follow the advice of Macchiavelli, much as we may dislike its ethical aspect. And the words of the wily Italian were: "Treat your friend as if he might be your enemy to-morrow, and your enemy as if he might be your friend to-morrow."

Probably the first and foremost reason which makes an attack by Russia upon England in India at present unlikely, is the powerful position which the latter holds there. The experiences of the present tribal war tend also to prove that the quality of the troops available for the defense of our empire, and our powers of organization, are worthy of our vastly improved strategical position. Of the latter it need only be pointed out here, that we hold all the advantages of a reëntering fron-

tier—that is, the position which Germany held towards France in 1870—as regards an enemy advancing from Afghanistan. Of other possibilities in favor of our defensive power, it would be neither wise nor patriotic to speak here. But if the power to pry into our own defensive measures is denied us, no similar restrictions exist with regard to the offensive capabilities of Russia. And indeed such speculations are at present freely indulged in, both in the continental and our own press; the former, or a section of the former, professing indeed to hold what it styles "Le conflit Anglo-Russe" as inevitable, if not now silently progressing. But besides the actual toughness of the nut to crack, and the possibility of finding a line of lesser resistance in another direction, offering greater advantages to the great Slav cause; there are difficulties both in the position in Europe and Asia, which have also to be considered in the question. One is the control of the ocean by Great Britain, which the combined navies of Russia and France could not with ease wrest from her. Another is that, were the Dual Alliance to find vent for its superabundant energy, in an attack on England, the opportunity it would thereby offer to the coalesced central European Powers, might be too tempting for them to let slip. Or even supposing that this danger were averted, the necessity of warding against its possibility would entail vast simultaneous efforts in Europe. It is only necessary to remember the disadvantages which Russia labored under during the Crimean War with regard to the attitude of Prussia and Austria, or her unfavorable position even when at San Stefano during the last Turkish war, with her communications at Austria's mercy; to prove that this is for her no mere imaginary danger.

There is however a class, with whose members, doubtless, the wish is father to the thought, who profess to see in the case of an Anglo-Russian conflict in Asia, nothing but inevitable disaster to Great Britain. In the columns of a London newspaper with an enormous circulation, there appeared, quite lately, an article dealing with Asiatic policy, which states that the Russian government is now devoting all its attention to the Indian frontier, and that in backing up Turkey on recent occasions, she has been securing for herself an Asiatic alliance which may be very useful, when there happens—as happen it must sooner or later—the inevitable struggle with England, who has schemes of conquest in Eastern Asia which Russia cannot look upon with equanimity. Of course the correspondent who telegraphs this matter is himself absolutely loyal aud frank to his country, and doubtless desires to put her on her guard as to the insidious advances of her pseudo enemy. Whether he is helping the cause of good-feeling and peace by transcribing this information is another qnestion. His informant proceeds to say that "Everything which is now going on in Central and Eastern Asia is but the prelude to the decisive conflict which is bound to take place between the two powers for the possession of India. Every obstacle placed in the way of Russia in other directions is simply intended to close the

road to Hindostan." The "personage" continues, and this is the portion of his statement which I particularly desire to investigate: "By means of the Trans-Caspian Railway, the excellent army of Russia in Turkestan and the Caucasus can, in a very brief space of time, seize Herat and occupy Afghanistan with a force of 350,000 men, and the transport of warlike stores and supplies can be carried out without difficulty through the Caspian Sea, two routes being available, viz., across the Black Sea and up the river Volga. The English are unable to understand the significance of the military road which has been made across the Pamirs as far as Chitral, near the Indian frontier, but that road is also directed against them. Russia has no need to secure the lines of communication in her rear, for, thanks to her knowledge of the proper manner in which to deal with conquered peoples, their devotion to her is guaranteed.

"The position of England, however, is different. The Indian population hates British rule, and the Indian princes, only half free, have cast their looks for a long time past towards Russia. It is certain that Russia has secret allies, and that, you will easily understand, is a great deal. As for Afghanistan, England cannot reckon upon it, and not a year will pass from now before Afghanistan herself will turn to Russia for defense and protection. The Manchurian Railway will be built with the same rapidity as characterized the construction of the Trans-Caspian Line. With its opening Russia will acquire a dominating influence in China, which from that time forward will become practically Russian, just as is Bokhara now. According to the latest information from Tashkent, an important extension of navigation upon the inland waterways of Central Asia has been definitely decided upon by the Russian authorities. Hitherto the flotilla of vessels employed on the river Amu Daria has been used between the mouth of the river in the Sea of Aral, and the towns of Charjui, Karki, and Pata Kisar only; but after next spring the boats will ply as far as Faizabad, 200 versts (170 miles) further east. This step will bring the Russian steamer service to a point about 220 English miles, as the crow flies, distant from Peshawur."

This short and somewhat off-hand description of the intentions of a friendly power, might be calculated, invested as it is with some importance by the mere fact of its appearance in the columns of so well-known a paper, to cause some alarm. It is, however, so easy to place, on paper, hundreds of thousands of men at certain strategical points, and in reality so difficult to assemble and transport such masses to such spots, and feed them when there; that I propose to analyze very closely the difficulties which would beset Russia in such an undertaking, quite irrespective of the details of British opposition, were she in truth disposed to attempt the venture.

Before dealing with the means of transport, I will speak of the excellent, and it well deserves the name, army of Russia in the Caucasus and Turkestan. I take as my authority a pamphlet entitled: "The De-

fensive Strength of Russia," compiled by Major Maurice Rech, Imperial and Royal Austro-Hungarian Army, which appeared in the *Militär Zeitung* in 1892, and a translation of which by me was published in the May or June number of the *Journal of the Royal United Service Institution*. It agrees with the handbooks published more recently by authority in all but certain details of moves, which have tended to strengthen Russia's force on the Austrian frontier. In this I see that the army of the Caucasus, 11th Military District, consists of two army corps, both with headquarters at Tiflis, and quartered practically along the railway line Batûm-Baku, consisting of 100 battalions, 90 squadrons, and 42 batteries, besides a battalion fortress artillery in Kars, Batûm, Daghestân, Poti. The establishment of the 12th Military District, Turkestan, was 34½ battalions, 28 sotnias (squadrons of 100 men), 3 horse artillery batteries, and 10 field batteries. From this establishment 18 squadrons and 2½ battalions had been directed westwards, and to it must be added one battalion fortress artillery at Michaelovsk. It also included two railway battalions. The united armies of the Caucasus and Turkestan, therefore (deducting troops directed to the Austrian frontier) number about 132 battalions, 120 squadrons, and 65 batteries, or, say, at the very outside, 140,000 men. Therefore, it seems to me a very difficult matter to produce from this force 350,000 men, to seize Herat "in a very brief space of time." It would consequently be necessary to draw upon Europe, for the Siberian forces are not worth counting, to provide this huge host, and, moreover, to produce men to garrison such places as Tiflis, Kutais, Elizabetpol in the Caucasus, and Tashkent, Samarkand, Merv, etc., in Turkestan, which could not safely be left unoccupied.

Now regarding Russia's forces in Europe, they are so large as almost to take away the breath of an Islander, accustomed to consider a paltry half-million of troops as a considerable army. Russia can place in the field, in time of war, about 2,500,000 combatants, and the numbers of her Opoltschenie, or militia, probably exceed that number. But of these vast numbers, she cannot direct more than a small proportion upon Asia, for even supposing France were to assist her in a war against England, at least 2,000,000 Russians would necessarily be neutralized, as far as we were concerned; to be able to reinforce France's four millions, in case these latter were attacked by the eight million soldiers of the Triple Alliance. Even under the most favorable circumstances she could scarcely reduce the force which she now considers necessary, in the piping time of peace, to watch the Austro-German frontier, which consists of no less than seventeen army corps, at the very least 500,000 men. Neither could she afford to leave her Baltic provinces, the capital, and Finland without considerable forces. Bulgaria, Roumania and Turkey, must necessarily be watched; the troops drawn from the Caucusus and Turkestan must also be replaced. Her Siberian army would have to be reinforced. Deducting these various forces, which would amount at a reasonable computation to three million men, she might be able to arm

against England over a million soldiers, of whom a quarter would consist of Opoltschenie, or militia. It is needless to add that if her ally, France, was attacked by the Triple Alliance, Russia could not spare a single man of this million for use in Asia.

Having now shown, in as short a form as possible, what Russia's available force would be for operations in Asia, I will endeavor to ascertain what her powers for transporting and feeding such vast masses are; noting that, of the 140,000 men of her Asiatic army, everyone is supposed, in my calculation, to be fit and well, which is an absurd assumption, and further, that not a single man has yet been moved from his present garrison. The "personage" states, "that the excellent army of Russia in the Caucasus and Turkestan can, in a very brief space of time, seize Herat, and occupy Afghanistan with a force of 350,000 men by means of the Trans-Caspian Railway," and, moreover, that "the English are unable to understand the significance of the military road which has been made across the Pamirs as far as Chitral * * * which is also directed against them." It is also stated, that by next spring, steamers will ply as far as Faizabad—about 220 miles distant, as the crow flies, from Peshawur. Now, in comparing armies, numbers are not the only question. Almost equal in importance are the questions of discipline, training, leading, higher command, military organization, geographical position, rapidity of mobilization, power of strategical concentration, and the transporting power of the railway system. In the first four of these qualities the Russian army yields to none in the world; but in geographical position, rapidity of mobilization, concentration and railway-transporting power, she is very much behind other European nations, or, indeed, the British army of India. Her line of communications with Europe would consist, in South Asiatic warfare, of one single-lined railway, and a sea liable to sudden and furious storms, on which she has a flotilla, consisting of only fifty to sixty steamers, and two hundred and fifty sailing vessels, the latter totally unsuited for the transport of troops, but which could convey stores with tolerable rapidity. From Bakû to Ouzoun-Ada is 210 English miles. The port at Bakû has fair accommodation, but its use, and that of the Caucasian Railway, by the troops, would upset the important mineral oil trade, and cause considerable trouble. At Ouzoun-Ada, the landing-place is very shallow and unfavorable, and unless the facilities for landing troops at Michaelovsk have been enormously increased since I saw photographs of them a very few years ago, it would be a very difficult place to land troops at in large numbers. The alternate route across the Caspian presents the disadvantage of a poor harbor at Astrakhan, which is a very sandy place, and the landing ports are the same, Ouzoun-Ada and Michaelovsk. The actual Trans-Caspian Railway is a single line, with fair plant, with eleven stations between the terminus on the Caspian (Ouzoun-Ada), and a place called Kaaka—at the foot of the Hazar-Matchid mountains—a distance of 320 miles. The supply of water at

these stations leaves much to be desired if a constant flow of troops be considered. At Douschak is a road leading south to Mesched, and all this railway is open to attack from Persia, who would, however, scarcely dare to show hostility to her powerful neighbor. Then, about 160 miles of desert to Merv. This would be a place of assembly and departure for Herat—over 200 miles off—which distance would have to be covered by troops on foot. From Tashkent to Merv is 500 miles, of which the railway conveys troops from Samarkand—say 400 miles. But comparatively few troops would be sent to Merv this way. On the other hand, a large force might be massed at Samarkand, *via* Buchara and Charjui, where is a long bridge over the wide Oxus. As to the navigation of this stream to "Faizabad, 220 miles from Peshawur," the navigation of the upper Oxus is not convenient, and the steamers, unless much improved since Mr. N. Curzon saw them, are not of much use to convey men or animals. Faizabad is distant, nearer 300 than 220 miles from Peshawur; and the Hindu Kush, with passes of an altitude of 9000 to 12,000 feet at the gaps, intervenes. Moreover, the whole line of advance is threatened from Chitral. When one talks of conveying 350,000 men, of whom at least 200,000 must come from Europe, to Herat "in a short time," the difficulties of transporting, feeding the men, watering the animals, establishing hospitals, depots, etc., must all be taken into consideration. Those who have seen one army corps pass a single given spot, or even a division of 10,000 men, may conceive how gigantic such an undertaking would be. It is true that the Russian armies in Asia dispense with many things that we consider necessary, and, consequently, lighten their baggage train, and reduce their non-combatants to a minimum; but still, to move such a force to Herat, even supposing no opposition from the Afghans, would be an enterprise such as Asia has not seen carried to a successful issue since the days of Tamerlane or Genghis Khan.

It will be noticed that the difficulty for Russia lies therefore, not so much in providing the men for the invasion of India, but in getting them to places whence to start, and provisioning them when there. Herat may be the granary of Asia, but its supplies (even drawing on the neighboring Persian province of Khorassan) would not, according to the estimate of good judges, feed an army of 150,000 men for a period of six months. Supposing, then, even 200,000 men assembled there: in six months how would they be fed? A force despatched from the Pamirs towards Chitral along the "military road" alluded to, would, if over 10,000 strong, find the difficulties of the advance almost insuperable. From Karki, a force of comparatively small dimensions might advance *via* Saripul on Ghazni, and join the main attack from Herat. These combinations are well-known both in the intelligence departments of St. Petersburg and London. The means for repelling such possible attacks have also long ago been considered. It is not possible, nor, were it possible, would it be advisable, to attempt to describe the defensive

measures which would be adopted against such an advance or advances, nor to describe the strength of our Indian frontier, but it may be permitted to point out that its flanks rest on the Pamirs or the "roof of the world," a plateau not to be crossed for many months of the year owing to its extreme height; and on the rainless and almost waterless Mekrani desert.

It may be considered as possible that Russia will, in a few years' time, be able to mass a force of 200,000 or 250,000 men on the line Herat, Karki, Samarkand; and that of that force two-thirds may be fed at Herat.* But the question of how that force is to be moved towards India, even when Afghanistan is Russianized, is not an easy one to explain. It must be remembered that the factor of British resistance has not yet been touched on; and it is merely the physical obstacles to the concentration at Herat which have been considered. As to the dominating influence of Russia in China, that is again a question which leads to endless conjecture, for which I have certainly not room here. But it seems probable that if Russia is seriously occupied with her Manchurian railway, and the scheme of obtaining an open, ice-free port on the Pacific, she will have her attention so much engaged in the Northeast, as to prevent her undertaking hazardous enterprises in South Western Asia. If the bear has to devour the dragon he may, poor beast, surely be allowed some time to sharpen his claws before he attacks the lion, who is not exactly going to sleep all the time. The territory of Russia is so immense, that it may well be doubted whether the need for consolidating it, and improving the condition of her peoples, is not more likely to occupy her for many years to come, than doubtful and dangerous military undertakings. It is no secret that the august ruler of this great empire is a peace-loving monarch, whose ideas are rather bent on helping his subjects to improve their moral and financial position, than on imposing new and crushing money difficulties upon them. I may be totally wrong, but I cannot help thinking that in these ideas, and in the generally pacific nature of the whole Russian nation, lie barriers against the waging of war more formidable than either the mountains of Afghanistan or the bayonets of the British army. But I would none the less, on that account, urge with my feeble pipe that those bayonets be well sharpened.

* The line from Merv to Kushk, about 187 miles long, is almost commenced. This, when completed, will much facilitate the advance from Merv to Herat. But it will probably be a single line only, with the attendant disadvantages, for only nine million roubles, or say £1,250,000, is allowed for its construction.—C. E. D. B.

THE FOURTH ARM.

By Colonel MARK S. BELL, V.C., C.B., R.E., A.D.C. (p. s. c., Commanding Royal Engineer, Western District),
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(*From the Journal of the Royal United Service Institution.*)

THERE appears to be no satisfactory exposition setting forth the duties and scope of action of the engineers in the modern battle-field in coöperation with the infantry. My first ideas of what they were capable were imbibed from a long, daily, and most intimate association with a much-loved and respected commanding officer, the late lamented Colonel Robert Home, C.B., R.E., who, at the time that his work on "Modern Tactics" was being published, talked over its contents with me as we, for twelve long hours daily, tramped the jungles of Ashanti; and had he lived he would doubtless have further enlarged on the tactical value of the engineer arm in the field; for, he was a man in a thousand in that, to him, theoretical knowledge was not theory, but a real, practical knowledge, so living and active were his ideas on tactical subjects. Ideas and opinions form and gain strength as one ages and hears and reads and ponders, and I am now more than ever convinced that there is in the future a rôle before the "fourth arm," in the fore-front of the battle, as glorious as that which they enjoy when a siege is being actively pressed or a defense being stubbornly conducted.

The immediate cause of my having to express my views arose on the occasion of assisting volunteer officers in working out a war-game. I found it easy to tell them that they would find in Part V. of the Infantry Drill-Book an excellent statement of the duties of cavalry, artillery, and infantry in combined tactics; but the question naturally arose as to the employment of the engineers—this fourth arm so capable of giving essential and efficient aid, and of whom so much is possible. We searched this treatise on combined tactics in vain to find their mention, and yet coöperation should be required of them in every stage of the combat. If they are thus ignored in the Drill-Book and no rules or even suggestions laid down for their employment on the battle-field—the goal of all tactical operations—how can a general on service, or when conducting manœuvres or the "game-of-war," their peace prototypes, be supposed to utilize them to the best advantage, if he had not exercised himself in doing so on every occasion and in every act of war? That all arms should act in concert is essential to success, and want of it is due to inexperience, personal ambition, and jealousies between men and the different arms of the service. Every commander who cannot bring into coöperation all the four tactical arms and work them in unison and

mutual support, and as infantry auxiliaries, and who from want of appreciation of its value loses the support "always useful, never harmful," which the art of the engineer can give, must be considered to be wanting.

To aid, then, my volunteer friends in their map and skeleton manœuvres, taking Part V. as a guide, I explained to them the manner in which, according to my lights, the omissions as regards the coöperation of the fourth arm might well be filled in.

The essential point in war is to decide quickly on action and to carry it out; the secret of victory lies in superior will and limitless energy, and, in order to come to a proper resolution, knowledge must guide the will. Knowledge is power, and information the sole means by which a mass of troops can be electrified into harmonious and concerted action.

To gain information (Information, S. 108; Reconnaissance, S. 110), engineer officers are required with the advanced cavalry reconnaissance, or in its wake. During this reconnaissance the engineer staff will take special note of all features of the ground, etc., that may be turned to a defensible account; that are capable of giving to the troops positions favorable to periods of rest and resistance; that will aid an advance and facilitate, if necessary, a retreat, etc.; for, as will be seen later on, they may be called upon to bring to account the aid that this knowledge can give to the infantry. They must carefully reconnoitre all passages required for the advance and the retreat. The reports brought back to the general from all engaged in this reconnaissance should materially aid him in settling on what part of the field he will make the assault; on what part he will act on the defensive-offensive, in a holding position; he will, at his discretion, probably utilize his engineer staff to aid in the execution of both operations; the various staffs being intimate with his wishes can further his aims intelligently, working towards one goal. Without the knowledge gained by this preliminary reconnaissance the general cannot (S. 111) distribute his troops in a manner "which lends itself most readily to the development of the plans" he has immediately in view.

The various sections of the battle-field will be more thoroughly reconnoitred by the generals called upon to operate in them during the artillery preparations for the fight, and a gradual advance be then made by them to seize and hold points of advantage, etc.

The reconnaissance from the special point of view of the engineers must be uninterruptedly continued, and they must be enabled by it to foresee and arrange beforehand for rapidly fortifying the important positions to be gained by the infantry, to arrange to pass cavalry and artillery without loss of time over partially-destroyed bridges, and over which infantry may have passed in their forward movement, etc.

The balloon sections will materially aid in these most important reconnaissances.

This thorough reconnaissance of the battle-field is, then, all-important, for every manœuvre must pivot on some point of support, whether a feature of ground, field work, stationary troops, etc.; the point of support must be abandoned when its transitory use has passed, and it must not prevent the offensive being taken, although it may temporarily serve the defensive. There will be no purely defensive battles in the future ; both forces will eventually assume the offensive ; and a general, whilst seeking to outflank his enemy, must guard against being outflanked himself by a skilful employment of field works and a good disposition of troops.

A few specialists of the engineers will be required with the advanced cavalry to assist in destroying and reforming communications, and to tap and repair telegraph wires, etc. A detachment may be required with the artillery ; they, however, should be exercised to, as far as possible, throw up what cover they require for themselves.

The bridging section of engineers must be well to the front, and the preliminary reconnaissance will enable the general to direct its operations and those of the telegraph battalion, and the latter must at ance proceed to connect the various sections of the battle-field with headquarters, and to keep up connections with it.

These special troops should come early into action under cover of the advance, for they must foresee and forestall exigencies, and not be delayed by them. As upon the engineer-in-chief devolves the responsibility of insuring that they act in concert with tactical requirements, it is apparent that he must be intimately acquainted with the plans of the general.

Although officers commanding Royal Engineers with the main units must constantly join their headquarter staffs to ascertain the views of the generals commanding them, yet they should frequently proceed to the front to ascertain what engineering works are required to aid both the offensive and defensive actions, and to insure that the engineer arm is coöperating effectively.

During the advance, S. 124, 4, lays down that the third line should take up a good defensive position where, in the event of reverse, the enemy can be effectively checked, and behind the flanks of which the first and second lines can be safe, at least for a time, from anything like an effective pursuit. It also directs that when about 500 yards from the position, more or less according to the nature of the ground, the firing line should endeavor to establish itself in good defensive positions all along the front, whence, as from a first parallel in a siege, both false and real attacks can be made on the position in front.

Whilst his infantry is advancing then, the general has to consider how to give the best effect to the above instructions. We may assume that the officer commanding, from his commanding position (S. 127 1), will have formed, with the aids of the reconnaissance reports, some idea of where these positions are to be found. They have to be taken up

under stress of action, and the question naturally arises how the general can best bring the knowledge which his *coup d'œil* and special information have enabled him to form to influence the action of the firing and third lines. So long as a general can keep the eyes of his soldiery upon him, he holds their attention and they silently obey all orders; yet another moment and they are beyond his control and dominated by the tempest of the fight; they must then do the best they can for themselves, and this at a time when he requires them most under his command. By decentralization alone can he regain command and keep his troops mobile and elastic. It is now that a staff intimate with his plans can step in and control in a measure for him; this they must now do, and happy is the general who can so influence those upon whom he must rely as to cause them to work together in concert, like hounds on a scent, to gain the goal he has set them.

The company training of the infantry must suffice to enable them to intrench themselves in the firing line, and this training must have been most careful and thorough to insure their making good use of the fleeting minutes; hasty cover is all that can, as a rule, be provided; shelter-trenches, or pits, or walls of clods; walls and hedges when they exist, etc.; in a few cases some sappers might have to be pushed forward to aid the infantry in preparing for defense some specially important *points d'appui*, or to destroy obstacles that hinder the advance.

The position in the firing line must be taken up to give the artillery time and opportunity to support the assault and to enable the general to arrange his second line in depth in front of the position to be assaulted, and preparatory to striking the overwhelming blow. Work at this range is only possible from the moral effect its occupation has on the defenders, and which by unsteadying their nerves leads to much unaimed fire.

During the advance *points d'appui* should be fortified to prevent a check degenerating into a rout. The divisional engineers can thus be immediately utilized, and they should closely follow the battalions of the first line (S. 124); the corps engineers are directed by the corps commanders as to the special points to be fortified, villages to be occupied, passages to be improved, bridges to be destroyed, etc.

The sappers can aid materially in preparing for defense the positions to be taken up by the third line by assisting the infantry in occupation of the *points d'appui* to complete their defense and to improve the defensive position generally by field works, under which heading are included abattis, loopholing walls, hedges prepared for defense, etc.

The engineers with the offensive sections use their rifles when required to do so, and until they set them aside for the crowbar, pick, spade, or other tool. This alternate use of the rifle and tool requires to be practiced not only by the engineers but by the infantry, parties of whom must be told off to assist in destroying obstacles, and, as shown above, field intrenchments is one of their important duties. We have yet to

teach the infantry soldier that in the modern battle-field the intrenching tool is second only to the rifle in importance, and that he must turn from the one to the other as the exigencies of the fight direct. The technical duties of the fourth arm should, as indicated, absorb all their energies, and it is but rarely and on an emergency that they should be called upon to act as infantry pure and simple. To so employ them as not to utilize them to the best advantage, and having regard to their limited numbers and the difficulty of filling up vacancies they should only be called upon to act as infantry when appreciable advantages are to be gained from it.

To rapidly select a line of defense, improve and hold it for such time only as the tactical situation requires it to be held, and under a more or less heavy fire, requires an experience that our troops do not yet possess, because it has not been gained by training, by practice during manœuvres —either field or skeleton—or by tactical exercises on models or by map manœuvres. Our army is composed of the longest service troops in the world, and their long training and discipline should give them a temper, character, tenacity of purpose, and manœuvring power superior to what it may be possible to expect of shorter service troops. It is not, therefore, admitted that our men would incline to keep to their hasty intrenchments ; they would gain in *morale* on taking the offensive from the temporary cover they afford, and by so doing would introduce the unforeseen into the battle and disconcert the enemy's plans. It shows narrow-mindedness to reject field defenses, for all forms of battle must be used as required, and all subordinated to keeping the initiative, and to subjecting the enemy's movements to your own.

We must always remember that the attack, whilst preparing certain points for defensive action, will only occupy them on compulsion ; the initiative will be kept up until the troops are forced to resort to the defensive ; they here reform to regain strength for a further effort.

S. 127, 5, lays down that the attacking force must ever be ready to assume the defensive, and that commanders must therefore, during the advance, be on the lookout for positions suitable for defense ; and paragraph 6, that should a retirement become necessary it must be conducted by the successive retirement of alternate portions of the force, those in rear occupying the strongest positions offered by the ground, intrenching themselves if time permits.

Now, at manœuvres, strange to say, time never does permit ; and it is to this that the want of reality in our method of practicing an attack is chiefly due ; want to appreciate it leads to a vicious training, and the acquirement by the troops of vicious practices : a training to please the eye and humor the spectator, and not calculated to lead to a true war efficiency. We forget that habit becomes second nature.

The modern battle-field is not what we love to depict it—a succession of volleys and rapid advances succeeded by independent firing, the charge and the hurrah ! Rather is it a slow and weary wearing away of opposing forces, both moral and physical ; an advance that progresses

only *pari passu* as the courage and fortitude of the enemy are overcome and his strength exhausted; an advance only to be made step by step and by superior courage, endurance, and leading. It is to this peculiar character of the modern battle that the increasingly important rôle of the fourth arm is due. It has now time to make its action felt; formerly, in many cases, it had not.

Generals must now habituate themselves to direct even battles by maps, for from maps, amplified by reconnaissances, he can obtain information sufficient to determine upon a plan of action, and to enable him to seize the initiative. The desire to be too fully informed leads to inaction, and to one's plans becoming subjective to those of the enemy. Napoleon's method, *on s'engage d'abord et on voit*, should be followed. Clearly-defined opinions on action to be taken in battle are most essential, for the chief can only indicate the aim, and leave it to subordinates to gain it. With the size of armies decentralization increases and all must, more or less, mechanically work to one end, and this must be practiced in peace if to be attained in war; centralization in peace-time is bad, but in war-time it would be disastrous. Method, then, is all-important; it prevents indecision, and gives a solution that can be adopted, unless, upon reflection, a better one offers itself. A good method leads officers to judge similarly of tactical problems as they occur, and accustoms them to certain formations. Method alone can obtain concerted action, and none need fear that it will kill genius, for genius is a birth, and will dominate all. Everything in battle should not be left to the spur of the moment, and the best methods are learnt only by experience (manœuvres) and by following formal directions. He who bungles in peace manœuvres will not find a solution for action in war when he has failed to find it under circumstances altogether more favorable for doing so.

A position being gained by an assaulting party should be intrenched. The engineers, with their tools, must be close at hand to aid in strengthening the position won; here again their chief duty will be to strengthen the *points d'appui*. Thus intrenched, the major portion of the other arms are placed in a position to pursue vigorously, meet counter-attacks, and turn a retirement into a rout—in a word, to act with the greatest boldness, and with a feeling of security as to their rear.

We have hitherto considered action in the offensive section of the field only; let us now conceive a battle-field extending over, say, ten miles, and a general commanding a corps of three divisions ordered to magnify his strength so as to deceive the enemy and to take up a "holding position" extending over a frontage of from two to three miles or more, so that the Commander-in-chief may be relieved from all anxiety of his line of attack being here broken into, whilst in another part of the field he pushes the attack vigorously and assaults with overwhelming numbers the positions out of which he has resolved to turn the enemy at all costs, and by so doing to force him to evacuate the whole. To effect this it will possibly be necessary for two divisions to advance with intrepidity to the

nearest point to the enemy that they can without undue losses attain, and, while still pressing the enemy, to take up a defensible position of some depth and to strengthen it.

This operation requires that all engaged in it be highly trained in its execution, if it is to be carried out expeditiously and effectively so as to hold the enemy as it were in a vise and prevent him breaking through the line of attack, and from withdrawing troops to strengthen other parts of the field where superior numbers are advancing to overwhelm him. To bring it to a successful issue all available engineer troops should be brought up to assist the infantry.

Difficult as this operation may be, every commander should have practised to give effect to it. Upon the infantry falls the duty of doing the main part of the digging, loopholing, abattis, etc., and the engineers can possibly only take the *points d'appui* and insure security to the flanks, and that here is some unity in the works carried out over the extended area the general has determined to hold on the defensive-offensive. The staff must aid the general in this operation as in all others; such an area must be held in depth, and commanders can possibly best obtain the results they aim at by utilizing the staff constituted for this purpose, *i. e.*, the engineer officers under them. There can be no question of useless work being done, for works will be dictated by the tactical requirements of the fight; generals cannot see to details, and the work will chiefly fall on the majors of half battalions, company officers, and the engineer staff. The general is the leader of the orchestra, who plays no instrument, but regulates the harmony of the whole and on whom all depends. The aim of the fourth arm, then, is to instil unity of effort; by reason of the conditions under which the modern battle is fought, it has become an essential to security; each commander of an infantry unit will defend the ground his command holds and forced upon him by the tactical necessities of the case; the engineers will be utilized at the special points, on which the general defense may lean for support and on which it may pivot, and in giving to the defensive line all its value.

Let me not be misunderstood; the engineers lay out no lines of defense, that line and area being determined by the exigencies of the battle; it is their duty to act as the staff officers of their immediate generals, and by their special knowledge of details to give them what support they direct.

It is often most essential that engineer officers with commands should take the initiative in carrying out their special field duties, such as reconnaissances of positions, passages of rivers and swamps, etc., preparations for defense, construction of bridges, and reëstablishment of communications destroyed or obstructed by the enemy. In all such cases they must keep commanding officers informed of what they are doing and the object of their work. The general commanding, his chief of the staff, and what may be called his tactical staff, will be too absorbed

in the direction of the fight to indicate to the engineer staff and regimental officers how their arm can best aid in its development and insure the success of the tactics adopted under the varying conditions of the battle; and the engineer officer who does not take the initiative without promptings, who fears to act without orders at an important tactical time, or who, whilst awaiting them, remains a passive spectator whilst the tactical action is developing, instead of actively aiding in its development—shows himself to be unfit for his position, and he certainly would not be the "right man in the right place." The spirit of initiative must never be wanting in an engineer officer.

But the initiative of subordinates must have a limit. The general must never lose control, and must intervene when necessary to remedy errors, and to indicate conditions required for success and towards which united effort is indispensable; the chief whilst regulating the whole leaves the particular action of each unit to itself, and looks to all to act in the sense of the general idea. He holds the reins, and units may disobey the letter of his orders whilst obeying their spirit, if local circumstances require them to do so. Excess of initiative shows want of confidence in the chief, and for success there must be confidence that all ranks, in their respective spheres, will fulfil their special duties; the initiative consequently must of necessity be restricted, and is only allowable when duly subordinated to the chief's aim.

On an army taking the field, an "engineer-in-chief" is appointed to the staff of the officer commanding in charge of the effective distribution of the engineer arms, to arrange for the allotment of engineer stores provided for the army, to supervise and facilitate the work of the different details of engineer services, and to deal with engineer questions generally. To the staff of the general officer commanding an army corps is appointed a "chief engineer," and to those of independent units and lines of communications "staff engineers," who are charged with the administration of the engineer arm with their units and with the general supervision and control of the engineer services carried out by them.

C.R.E.'s with divisions and on lines of communications command the engineers in their command, excepting the telegraph, railway, and balloon units; these latter are under directors; C.R.E.'s, however, will be responsible that all the details of engineers work together to the best advantage.

A general cannot be supposed to remember all the minutiæ of numbers, of time, and tools required for defensive works, and may be naturally expected to trust to his engineers, whose business it should be to indicate the golden mean, what is possible, something or nothing, in the time that the general calculates that his troops will be occupying special positions; and to cause his orders to be conveyed to the units concerned by his engineer staff, who can then with their special arm assist materially in executing what it may be advisable to attempt to do, and avoid

doing what had better be left alone, and give to each arm what assistance their technical training may enable them to give.

A commander may lose the opportunity of his life should he neglect to fully utilize works that it may be possible to execute in the time available to aid movements both to the front and rear, the offensive as well as the defensive. Such an application of field works to tactics, notwithstanding that it is indicated in the Drill-Book, as we have shown by the references we have made, is still a theoretical one only, and we should determine to practise it during manœuvres and on every possible occasion. Let us, to this end, accustom all units, with suitable proportions of all arms, to take the field with their tool-carts, and to test the best way of utilizing field intrenchments in the firing line, the third line, and when occupying an extensive holding position extending over two or three miles of a varied country, at the same time that the offensive is being taken on one or both flanks; and organize a staff to give unity of action and effort to it.

As a result of such an exercise, the question will possibly arise as to whether our infantry company training sufficiently instructs them in what will be required of them in the modern battle-field. Their instruction, carried out on "field-work grounds," *i. e.*, any vacant space that may be available, gives to none any idea of the application of such works to the tactical requirements of ground being altogether unconnected with tactical exercises, etc.; trenches are of necessity thrown up in hollows and other impossible positions. On tactical exercise grounds and on manœuvres the lines of the intrenchment or redoubts might be represented by the lines of implements, the men at their digging posts, and the troops thus practically taught to make the best tactical use they can of what ground they come across to gain the ascendancy.

"Time for the construction of works in the field does not so often fail as the presence of tools and of the engineers at the right time on the right place."—MAY.

The retirement has already been referred to, and S. 121 (1 and 2) points out that success in a retreat depends on the completeness of the arrangements which have been made beforehand—presumably by some one having the leisure and means to make them. Every detail should have been considered, so that when the time arises little remains but to issue the necessary orders. If a retreat is not to degenerate into a flight, the reserve or freshest available troops must take up a position to cover it; if such a position can be found towards a flank, it will relieve the retiring troops by drawing the enemy off the real line of retreat. Every obstacle should as the troops retreat be thrown in the way of the enemy's advance, by destroying bridges, setting fire to villages, etc. In a retirement, then, we find ample scope for the action of the fourth arm, both independently and in close coöperation with the infantry. Why not then practice this operation in peace as laid down to be conducted, and with the infantry and engineers in coöperation?

Why, when such real work is awaiting them in the field and in every stage of the battle, can we find nothing better for our field engineers to do during peace manœuvres than to act as infantry or to see to camp water supply? the latter essentially a peace duty, for in war in civilized countries, to carry out which we train, we should compel the civil authorities to arrange this for us.

The Defense.—The requirements of a defensive position are given in S. 128, and before one can be occupied it has to be reconnoitred and the troops distributed in three lines to hold it (S. 128, 6). No hints are given as to how the engineers should coöperate in furthering the general principles laid down for the occupation of the position, although it may be supposed that their special study of field works on a large scale, and their application to tactics and the ground will be fully utilized. The ideas put forward as to the manner in which their services may be advantageously employed in the more difficult operations already considered will suffice to indicate how they can be best employed on the defensive in intimate coöperation with, and in aid of, the other arms. The pure defensive on a large scale, it must ever be borne in mind, is fatal to success, and must always be taken up with the idea of the ultimate offensive so soon as all advantages inherent in the defensive form have been gained.

The infantry soldier need be under no apprehension that the engineer wants to do his work; there is more than ample scope on the modern field of battle to fully tax the energies of both arms. The only object of these notes is to point out that the work that has to be done can be best done by the infantry with the most intimate coöperation of the engineers, and that to ask of infantry to do all that is laid down that they shall do on the battle-field without this coöperation is an impossibility. With every nerve strained, say when "long range" fire is reached, with all their energies required to keep their units in hand so as to obtain of them the greatest development and concentration of aimed fire consistent with a steady, but maybe slow, advance, and, indeed, to give effect to all the excellent instructions laid down in S. 125, 1, 2, how can infantry officers find time to look about them for positions favorable to defense, or to cover their retreat; S. 127, 5, 6; S. 124 (4)? or to see how to make the most of the defensive possibilities of the very front they are occupying, of which they know nothing beyond what is immediately in their front or on either hand of them? Such main considerations must be left to the general reserve, S. 127, 3, and a special arm, the fourth arm, following the attacking line up closely, and keeping as much out of the thick of the fire as is consistent with gaining a full knowledge of the defensible ground to the front and flanks of the force of which they form an integral part, ready to take up their part of the task. On manœuvres infantry officers may be able to think more of these things, but when bullets are falling as thick as hail and all depends upon their leadership they have to turn their attention to what

most concerns them—the conduct of their men. As this will absorb all their energies the general will do well then, we think, to push forward to coöperate with them in giving effect to the less dashing and all-absorbing but not the least necessary requirements of the attack, a special arm to give the impetus required to carry out his orders relating to the defensive positions that might, in a stubborn resistance, have to be taken up by the firing line, the third line; in the defensive-offensive section of the field, etc. Their intelligent coöperation with the infantry is a means whereby a commander may gain full advantage from feints, stratagem, surprises, etc.,—tactical elements so productive of victory. Their advent in the fight should act as a sedative on the over-strained mind of the infantry, and help to instil that nerve into it which is so necessary for cool and determined action.

The plans of an advancing enemy may be altogether disconcerted on their finding themselves unexpectedly confronted by a few well-situated *points d'appui* held on the defensive. "The engineer, in virtue of the character which is peculiar to his branch of the service, may hold an equilibrium in military operations. He may render the success gained by an impetuous attack secure, by quickly throwing up field works behind the attacking force, and in the same manner stop a retreat by hastily-constructed intrenchments, the holding of which then concerns the honor of the troops."—MAY.

My object was to point out to my volunteer friends how they might employ the engineers when engaged on a war-game exercise—a skeleton manœuvre; and what an important rôle was theirs in the attack as well as defense, notwithstanding that it was not sufficiently practised at manœuvres, and but indicated in the drill-book—naturally a conservative compilation, but which changes *pari passu* with the times, and in changing will in time doubtless emphasize the advantages to be gained by the active coöperation of the fourth arm in the battle-field, and not leave all its actions to the spur of the moment, and the initiative of the engineers. Nothing, therefore, was said relative to the essential services that fell to the fourth arm in fortress warfare, whether in the attack or defense; in the latter, whether in the enceinte or in the main or advanced line of works; and, in the former, whether with the hidden batteries, close attack, approaches, communications, hutment, base, etc. —their employment here is indeed *Ubique quo fas et gloria ducunt.*

The general who uses his engineers to aid the battle in all its stages will surely gain from it an advantage he wots not of. All will come with time and opportunity, which the engineers should seek. They must practically exemplify that not only in a siege and defense is their motto a true one, but that it is true also in the modern battle, in which they should be represented, from the cavalry reconnaissance to the reserves acting in rivalry with the other arms. This may be safely left to the rising generation of the corps to effect; to the captains and subalterns, whose young, vigorous, and impressionable minds will find in it

a task worthy of their steel, and they may surely expect that in their day as hard fighting as ever we have had will fall to them. The training of the engineer officer, the early responsibility thrust upon him, etc., all tend to form in him a self-reliant character. The rank and file also are early compelled to rely on their own judgment and resource, and such qualities are not to be despised on the day of action, for they are factors making for success. Paucity of numbers has led to their value in the field being overlooked, and the fact of their being artisans has caused them to be worked too much as specialists in the field. Their numbers for their field duties require to be very largely increased, and this might possibly be the best, and also economically effected by adding to each artisan company one or more companies recruited from laborers, porters, navvies, and miners, etc., thoroughly trained in all field duties. With the company sectional organization, such an association should be productive of the best results, and we would see a section of artisans working with a trained company of pioneers, and associated with infantry, one such section and company at least to a brigade, in a manner to gain by it all along the line. Such militia corps as the Royal Monmouth R. E. (M) are recruited from these classes, and when, on embodiment for field service, they shall have been given the extra training necessary to fit them to take their part in the first line of battle, they will form a most valuable addition to the Regular corps.

Each company of infantry in the French army has an assortment of 48 tools carried by the men, and a load of 30 full-sized tools carried on a mule. The engineer companies (sappers and miners) carry 174 portable tools, and with its park are 2 four-horse wagons for tools, and 2 mules to carry dynamite and detonators, etc. In addition, are the corps engineer park carried on 11 wagons and the army engineer park of 60 vehicles, and which can furnish the following full-sized tools:—4200 shovels, 2130 picks, 686 spades, etc., and spare portable tools for the engineers; it also carries 8400 sand-bags, 1102 lbs. of powder, and 2645 lbs. of dynamite. Such explosives as mélinite and crésylite are also carried by the artillery, as well as Bickford fuse, dynamite cartridges, etc. The intrenching tools, with the artillery, are carried on the wagons.

"The French made little use of their engineers in their last great war; had they at Gravelotte used fortifications to support the troops, with judgment, a different result might have followed."—HOME. Their tool carts could not be brought up.

Recent French writers give great prominence to the necessity of the coöperation of the fourth arm on the modern battle-field in all stages of the fight, which may last for two, or even three, days.

General Prudhomme teaches that a retreat must be effected under cover of a reserve of all arms, which has prepared an intrenched position, and that fortifications must be also employed to hold positions against offensive sections, or to gain shelter whilst occupying a holding position, etc. On the defensive (to be transformed into the offensive when it has

utilized to the utmost the advantages of ground), the supporting points in the first line are to be intrenched, and, as well, two lines in rear to facilitate its evacuation if necessary; shelter-trenches give cover to troops between the supporting posts. As these defenses will only be occupied when the enemy shall have developed his plans, these works will probably be laid out by the engineers under the general's orders, and executed by them and the infantry detailed to hold them.

General Philibert gives to his engineers a most important rôle; he points out that the regulations refuse to admit it to be possible that French troops should ever retreat, but considers that they should, nevertheless, be trained to act on the defensive and to conduct an orderly retreat; to this end his plan is to cause the reserve to occupy a rear-guard position, 1200 to 1600 yards in rear of the fighting line; the position to be fortified by the engineers, under the general directions of the general, aided by the troops destined to hold it; the troops in action in first line to suddenly break off the engagement and to hastily retire, so as to unmask the rear-guard position, and to reform on a pre-arranged rendezvous a mile or two in rear of it. The attackers, he considers, will be stopped by the hot fire from the rear-guard position, and that the first attack must be re-commenced. The rear guard, strong in artillery and cavalry, and in having called to its aid ground and field fortifications, and with secure flanks, can delay the advance for some time without committing itself too deeply—an hour or more. It must eventually retire by successive lines from the front—first line and its supports, second line and partial reserves, line of reserves—each taking up successive defensive positions, one behind the other. It is now or never with the cavalry, and the engineers must give to the *points d'appui* and the lines of defense all their value. Throughout, counter-attacks to be numerous and in force.

On the defensive he causes his advanced troops to occupy cover and *points d'appui* to force the enemy to deploy; having effected their object they retire to unmask the main position, fortified in depth as well as along its front. The retirement of the first line, which is lightly held, should cause no panic in the second line, which should cover by its fire not only all the ground between the two positions but also that passed over by the attackers as they advanced to the crest of their first position (high-angle-fire).

General Lewal (from whose writings I have borrowed largely) believes that in the battle of the future, which will last two or three days, obstinacy and perseverance will be all-important. With large forces, a whole day will pass in executing manœuvres, works, partial attacks, etc., and no decisive result will discourage either side; during the night the struggle will continue in a modified form, to be recommenced with renewed intensity the next day; victory will incline to the side that makes the most of the hours of darkness in preparing for the next day's battle, in eating, sleeping, redistributing troops, and working;

intrenchments will be thrown up at points menaced, at points gained; gun-pits prepared, also shelter-trenches whence to harass the enemy's artillery; arrangements made for a covered advance, etc. Certain siege works will be called into play to cross by sapping open spaces, to mine against an enemy's heavy artillery and his main works of defense; platforms will be laid, and cover provided for the light siege park dragged by horses; and although some of these works may be useless, they should not on any account be left undone; their omission may be repented, never their construction. Both sides must persevere until one is completely exhausted; and field works encourage perseverance, and afford periods of rest, whilst they exhaust the attackers.

Each company of Russian infantry has 80 light Linnemann spades and 20 light axes; the heavy tools, viz., 16 spades, 8 axes, 3 mattocks, 3 pickaxes, and 1 crowbar, are carried in the divisional transport column. There are no special pioneers.

Each sapper company carries 100 light shovels, 70 light axes, 10 picks, 20 mattocks, etc.; and carried in carts, always with the company as fighting baggage, 40 steel shovels, 24 hatchets, 5 pickaxes, besides tools, 100 sand-bags, explosives (54½ lbs. pyroxyline, 108 lbs. rifle powder, etc.).

The Russians put great faith in the support that intrenching tools give, and consider their use to be an integral part of offensive tactical operations, and without which they would be incomplete.

The German field engineers or pioneers are not a model arm to be copied; at any rate up to 1870 engineers were not "made in Germany." In the offensive battle of Gravelotte, August 18, 1870, they were not usefully employed either for facilitating the movements of the troops or for organizing the ground defensively, although occasions were numerous in which rapid works might have been brought to aid the offensive. They were chiefly used as infantry, to extinguish fires, bury the dead, etc.

On the 16th August, two companies of engineers were usefully employed in fortifying the village of Vionville, and thus confirmed and established the success of the infantry.

In the defensive battle of Beaune-la-Rolande, fought on the 18th November, the engineer troops were not utilized at all, and the three days which preceded the battle were lost as far as any defensive organization is concerned, and the troops undertook what works they thought best, without any prearranged plan or unity of direction, the pioneer companies and the engineer officers taking no part in the performance.

Beaune-la-Rolande was placed in a state of defense, but even this work was done on no plan, and with no uniformity of idea. During the battle the pioneer companies remained inactive or fought as infantry, with the exception of one only, which was employed upon technical works which should have been carried out on the first day.

Generally speaking we see, therefore, that the German commanders,

and the engineer commanders themselves, lacked knowledge of how to employ the engineer arm, and that the latter showed great want of a spirit of initiative and foresight—qualities which should never be wanting in those to whom such responsible action is confided.

General Schobellof considered that the Germans in their manœuvres made a great mistake in neglecting to construct field works to aid their tactical offensive exercises, and that their engineers showes great inaptitude in adapting them to tactical requirements. When taking up positions to be held on the defensive, each commander is responsible for the defense of his own front, and they are well trained to this extent.

In the attack they trust to onward movement and overwhelming numbers, tactics which may receive a severe check when met by disciplined troops with well-seasoned nerves; it is a question whether two years' service troops, however good the material, would stand the losses that such tactics would then subject them to. Will they not be forced to seek shelter, and when it does not exist, throw it up? They would seem to have missed the "golden mean," but are in a condition to remedy their mistake should circumstances force them to do so, for in the infantry companies every other man carries a tool (100 spades, 10 picks, 5 hatchets, per company).

In the Austrian army 99 men per company (half a company) carry a Linnemann intrenching spade; the four pioneers carry 2 picks, 2 shovels, 4 hatchets, and 2 saws.

Every engineer company has 72 picks, 144 shovels, and 120 carpenters' tools, carried either in wagons or by the troops; in the wagons are also 275 lbs. of gunpowder and 363 lbs. of dynamite. In each army corps engineer park are also 400 picks, 750 shovels, 170 carpenters' tools, besides miners' and blasting tools, dynamite, and gunpowder.

In the Italian army each engineer soldier carries an intrenching tool of some sort; in the light wagons are carried the necessary tools for sappers and miners, as well as about 44 lbs. of explosive gelatine, and in the heavy wagons besides sappers' tools, sand-bags, explosives, miscellaneous engineer stores.

The infantry pioneers alone carry intrenching and assorted tools.

Military Notes.

CHARGE AND SPECIFICATION.

THE division of our military indictment into the Charge and the Specification dates back to the beginning of this century. The first case of the kind that has been found in the records of the Judge-Advocate-General's Office is that of Lieutenant John Roney, 1st Infantry, tried in 1808, on the two charges of "Conduct unbecoming an Officer and a Gentleman" and "Being drunk on Duty," the charges being sustained by appropriate specifications. But even after this the old practice, adopted from the British practice, by which (what we now call) the Charge and Specification were not separated but were given together as the Charge, was not for some time abandoned. Indeed at this time both methods were followed, the old more frequently than the new, and sometimes the two were mixed together, as when the arraignment was on:

"Charge and Specification 1st. Being drunk on duty while acting as a Centinel at Fort Richmond, Staten Island, on the 8th of April, 1814.

"Charge & Specn. 2d. Sleeping on his post, while acting as a Centinel at the time and place aforesaid."

The old practice seems however to have entirely given way to the new soon after this.

In 1809 an officer of the 4th Infantry was arraigned on charges which read as follows:

"1st. Disrespectful observations against the Government of the United States, in two instances.

"2nd. Ungentlemanly, unofficerlike & ungenerous observations, against Captn. Doan, his Commanding Officer.

"3rd. Entering Captn. Doan's quarters, and in a Clandestine way examining his private letters & papers.

"4th. Buying Soldiers Bounty against orders, paying five dollars for twelve.

"5th. Endeavoring to injure the credit of the U. S.

"6th. Neglect of Duty & want of application and military pride.

"7th. Unofficerlike Conduct in demanding a fee of twenty Cents for sleighs passing by him at Fort Richfurd.

"8th. Disrespectful observations against a general Court martial at Swanton.

"9th. For disrespectful & unofficerlike Conduct, in his observations

against a district Court Martial ordered by Col. I. Whiting, on the 24th on Novr., 1808.

"10th. Disrespect & Contempt towards Captn. Doan, his Commanding Officer, while in the Execution of his Duty."

The record in this case shows that, "The respondent moved, that the court ought not to examine 2d, 3d & 8th Charges, as they had been once settled by the parties to their entire satisfaction," and that the court were of opinion "that all personal difficulties which had been once settled, ought not to be investigated by the Court."

In another case there were these charges:

"Charge 3. Incapacity to perform a considerable part of the Duty of the Station in which he is placed, as an officer in the service of the U. S.

"Charge 7. Neglect of Duty generally.

"Charge 9. Unofficer & ungentlemanly Conduct."

"Spec. 1. Appearing on Parade in Burlington on or about 20th Jan. last, and at the Genl. Court Martial, on or about the 1st April, 1809, in a very indecent manner.

"Spec. 2. Walking in the public Streets in Tundingland in Company with other officers, without stockings, on or about the 9th June, 1809, thereby rendering himself an object of ridicule.

"Spec. 3. Marching without Stockings when on March from Swanton to Springfield and marching without them, during a great part of one day, on or about 7 June, 1809."

But the court were unanimous in their opinion "that the 3d Charge, in itself contains no Crime, and is not a subject for their decision—That the 7th Charge is too indefinite, & expressed in too general terms, for their investigation; And that the 9th Charge, in itself, being of too general & unlimited a Nature & as explained by its Specifications, too trifling for the serious consideration of a Court Martial"; and therefore took no cognizance of them.

With the records in the Judge-Advocate-General's Office is the following letter of Colonel William Drayton, Inspector General:

"Inspector's Office, Sackett's Harbor, 17th September, 1814.

"Sir:—The proceedings of the Court Martial (which are inclosed) appear to me to be regular, excepting in that part of them which overrules the charge brought by Mr. Ross against Doctor Buchner, upon the ground of Mr. Ross not being an Officer of the Army. I conceive that anyone may exhibit charges against an Officer in the Army: it is with the commanding officer to order the arrest or not as he thinks proper, and it is peculiarly the duty of the Judge Advocate to give form to the charges, with the substance of which he is furnished by the party prosecuting. The Government is supposed to be the Prosecutor, not the Individual: the object is to punish an offence against the Rules & Articles of War, & this object is equally obtained whether the information upon which charges are founded, be derived from a citizen or an

officer. I have the honor to be, Sir, most respectfully your obedient servant,

WM. DRAYTON,
Inspector General.

"Major General IZARD."

Some of the old court-martial proceedings were in good form, others very defective, as, for example, the following:

"The court met agreeably to the above order.

"Present.

Major Banney, President.
Capt. Gates. Capt. Harrison.
Lieut. Mason. Lieut. Seaver.
James H. Sargent, Judge Advocate.

"The court being duly sworn in presence of the prisoner proceeded to the trial of 1st Thomas Gardner charged with 'desertion from Lt. Wheelock's detachment of Light Dragoons some time in the summer of 1813'— to which charge he (being arraigned) pleads not guilty.

"Cantonement, Greenbush, 13th Nov., 1813.

"I, Samuel Shaw, Hospital Surgeon of the United States Army of lawful age do testify & say that on the 21st day of August last I gave Thomas Gardner leave to be absent from the Hospital for ten days by a pass which I inclose, which pass I have no doubt has been alter'd in the figure from one to nine changing the time from Ten days to ninety. I have never given a pass to any man for a longer time than Thirty days— and further the deponent saith not.

(Sign'd) SAMUEL SHAW,
Hospital Surgeon, U. S. Army.

"Sworn this 17th day of Nov., 1813, before me.

(Sign'd) J. H. WENDELL.

"One of the justices of the peace for the county of Albany in the State of New York.

"The court after mature deliberation on the evidence produced find him guilty and sentence him to thirty days solitary confinement on bread and water, refund expenses incurred by his desertion & apprehension & make up time lost by desertion, it being eighty days."

A number of cases, tried separately, were frequently recorded in the same proceedings, as for example, where in 1814, the proceedings in ten cases were recorded in three and one-half pages of letter paper. In only one of these cases, however, was evidence introduced. In the others the record would read like this:

"John Riely being arraigned on the charge of 'Deserting from Capt. Binney's Co., 4th Infy., & inlisting in Capt. Berry's Co., 40th Infy.,' pleaded 'Guilty.' The court finds him guilty & sentences him to thirty days solitary confinement on bread and water, six months hard labor, a stoppage of half his monthly pay during confinement to refund expenses of desertion, it being sixteen dollars for bounty received by inlisting in the 40th Infy."

There is also the record of a court-martial, held in 1813, in the case of Benjamin F. Mower, "a follower of the army," who was convicted of "violating the 56th Article of the Rules and Articles of War," in corresponding with the enemy, and aiding and abetting others in so doing, and "Disobedience of Orders," and who (the court believing that the act described in the specification to the first charge was not committed with any criminal intention) was sentenced "to be dismissed as a retainer of the army, and never to be permitted to enter the encampment."

In another case, tried in 1813, the accused was convicted of desertion, and sentenced to be shot to death, the record being endorsed on the back, without signature, "approved, and the sentence to be executed at 5 o'clock." It does not, however, seem to have been the practice in these days for the reviewing authority to sign his decision and orders.

In 1821 an officer (Captain D. Curtis, 2d Infantry) was summarily dismissed by the President, on the proceedings of a court of inquiry, which had been convened at the officer's request, and which did not even report any findings, but was simply a record of the evidence. He subsequently appealed to the Secretary of War, Mr. Calhoun, whom he addressed as "the statesman who ——

'Not waved by fleet opinion's every breeze,
Goes on to action as himself shall please.'"

He was, in 1822, by order of the President, restored to the rolls of the army, for trial, was tried by court-martial on charges and specifications covering the matters investigated by the court of inquiry, and was convicted and again dismissed in 1823.

THE MAXIM GUN.

The Maxim gun, as is well known, is entirely automatic, and will continue firing so long as the firing button remains pressed forward. Single shots can be fired by releasing the button immediately after a discharge. In that case the gun will be loaded and firing can be continued by again pressing the firing button. To commence firing with a new belt of cartridges, it is necessary to turn the crank handle until it touches the buffer spring. This draws the lock back and allows the carrier to drop into its lowest position. The end of the cartridge belt is then inserted through the feed block from the right and pulled through to the left as far as it will go and the crank handle released, when it will be carried back, thus throwing forward the lock; the carrier now rises and seizes the base of the cartridge in the feed block. The crank handle is again turned forward and the lock goes back, the carrier pulling the cartridge out of its belt and afterward placing it in a line with the barrel. The belt is then pulled again to the left as far as it will go and the second cartridge comes into place over the chamber of the barrel. On letting go the handle once more, the lock goes forward, inserts the cartridge in the barrel, and the carrier, in rising, seizes the base of the next cartridge in the belt. The gun is then ready to commence firing.

We have on previous occasions commented on the remarkable performances of the Maxim gun, which will discharge from a single barrel from 600 to 700 rounds per minute.

An interesting development of the rifle-calibre gun is that known as the "extra light." The gun can be placed in firing position mounted on a tripod; or packed and carried by infantry; or carried in a cavalry boot; or mounted on a tricycle.

The extra-light gun is not intended to take the place of the standard rifle-calibre guns just described, as certain desirable features have to be sacrificed in order to save weight. It has, however, the advantage that it can be transported to positions that might not be attainable by the standard gun within the space of time that would be available under certain conditions of warfare that might easily occur. It would be useful to stop a cavalry charge in an emergency, to check the sudden rush of a savage horde, or perhaps to cover a retreat; but it is not well adapted for an attack on a position, and is, in fact, a weapon of defense which might prove of incalculable value, but is not to be relied on in the same way as the standard gun. It would be also useful for police work in new countries, and, in fact, wherever a small disciplined force had to deal with much larger numbers of undrilled men who would become demoralized if their first rush were stopped. It is deficient in comparison with the standard gun, inasmuch as having, in its lightest phase, no water jacket, it cannot be fired continuously for an indefinite number of rounds, as the barrel would naturally get too hot and it would be necessary to allow it time to cool. Although the mechanism is, in its general features, practically identical with that of the standard gun, there are one or two trifling exceptions; for instance, the spring for absorbing a portion of the recoil energy, and for returning the recoiling parts to their firing position after each discharge, is placed within the casing in place of being outside. This change is made in order to get the gun into a narrow leather case. This gun, however, is now occasionally made with a small water jacket, by means of which the number of rounds that may be continuously fired is increased; but, as already stated, the standard gun with its full supply of water is always preferable when it can be transported, and it may be said that for regular operations of warfare the standard weapon is itself sufficiently light to enable it to be, as a rule, transported as rapidly as any considerable body of troops can be moved. The question of ammunition has also to be taken into consideration, and it is little use having a very rapid-firing gun unless it can be kept supplied with ammunition; excepting, as already stated, for purposes of dealing with a sudden rush.

The tripod mounting is made of thin tubular steel, the hind leg or trail being hinged midway of its length, so that it can be folded for transport. The front legs are provided with projecting legs at their upper ends, and these bear against the upper part of the tripod. The front legs can be housed along the hind leg. The gun is supported by a cross-

head pivoted to the upper part of the tripod. The crosshead is provided with an arm which has its bearing on an arc or segmental piece fixed to the hind leg of the tripod, as shown, and which carries the elevating gear. This arm can be clamped to the arc in any desired position by means of an eccentric clamp. The transverse movement of the gun is limited by two spring catches mounted on the ends of the arc. The weight of the gun is 27 pounds and that of the tripod 17½ pounds. The weights additional to those of the gun and tripod are 1 pound 14 ounces for spare parts and 11 pounds 2 ounces for the knapsack. This would make a total weight of 57½ pounds, or just over ½ cwt. Another man would carry the ammunition in much the same manner. Five hundred rounds of 0.303 smokeless ammunition would weigh just 44 pounds, while the knapsack would weigh 4 pounds.

The cavalry gun and tripod is the same as the infantry gun and tripod, but is packed differently. The tripod is carried on the near side and the gun in another case on the off side. The weight of the boot of the gun is 6 pounds, and that of the tripod boot 8 pounds.

The tricycle gun is a very interesting feature, but it is needless to say that it would only be available in districts where there were fairly good roads, and this discounts at once the great advantage this nature of weapon possesses in being transported with ease over difficult country. It may be, however, that the improvement in the motor car, for which we are still waiting, will some day enable guns of various natures to be transported with greater facility; but in that case an "extra-light" gun would be likely to have its sphere of usefulness curtailed instead of extended, for the saving in weight gained with the extra-light weapon would not be so important a factor if mechanical means were utilized for transport. Two guns are mounted on the tricycle. The weight of the cycle is 121 pounds, that of the two guns 54 pounds, of the tripod 17½ pounds, and of the spare parts, 8 pounds. A thousand rounds of ammunition carried in the boxes would weigh 87½ pounds. This is in all a good weight to propel, but we have seen the two riders drive the machine at a very smart pace on the level. Hill work would naturally be done on foot, the tricycle becoming a hand carriage.

The gun with the combined field carriage and tripod on their pack saddle is carried by one mule. Another mule carries the wheels, while a third carries the ammunition. The load for one animal is 2000 rounds; and, of course, the number of rounds that accompany a gun is dictated by strategical or tactical considerations.

The mule service is, naturally, for mountain warfare, but the end of the pole or back leg of the tripod can be hooked on to a limber, and thus form an infantry carriage for horse traction.

Another method of mounting the gun is that used on parapets. This ingenious parapet mounting would be exceedingly useful for fortifications or provisional intrenchments. It is shown on a wall, but can be used in connection with sandbags or earth embankments equally well.

There are two claws, one only of which is shown in the engraving. These grasp the wall, while the bottom of the rack is held to the ground by the weight of the gun, the latter being worked up by means of a pinion which gears with the teeth of the rack. When in firing position the gun can be secured by a locking device, and, of course, it can be easily lowered when not in use, so as to act as a disappearing gun. The facility with which the gun can be transported is an admirable feature in this design. As will be seen, there is a pair of wheels, and when the gun is run down to the bottom of the rack the wheels are on the ground, and support the whole weight. The carriage is then locked to the rack by a suitable device, the rack becomes a pole, and the securing arms are handles, between which a man can stand and push the gun in front of him. Military authorities attach considerable value to ready means of changing gun positions.

The standard R. C. gun is also intended to be used to accompany cavalry, and really becomes very light horse artillery of a very effective character. There is shown what is known as the galloping carriage with gun and ammunition boxes. Here, again, the gun is almost hidden, not only by the shield, but by the seats of the carriage. The breech end is, however, shown projecting from between the seats. This, of course, is the travelling position, but the galloping carriage is also shown in the firing position. The seats are turned over and form shields, being plated with steel for the purpose. The belt of cartridges is also here seen emerging from one of the ammunition boxes and passing into the gun. Twelve boxes of cartridges are carried on this carriage, the total number of rounds being 3000. This galloping carriage is quite a new feature, but several have already been supplied for abroad. The carriage has been pretty severely tested by the military authorities, in being taken at galloping pace over ditches, banks, etc., and it is considered that it would be able to go anywhere that cavalry would be able to act.

Turning to the naval service, we find various mountings for the R. C. Maxim gun. A cone mounting is shown which is much used, being adapted for ordinary broadside and other positions. The shield is generally used, as the gun is often placed in exposed positions. There is also a bulwark mounting for this class of gun, it being placed on the ship's rail, and can be clamped in any position. The bulwark is strong enough to well stand the comparatively small stress of firing. The same mounting is also used for military tops when there are gun positions on the mast.—*Scientific American Supplement.*

PURE WATER FOR TROOPS ON ACTIVE SERVICE.

Now that there seems to be a likelihood of our soldiers engaging in warfare, and in a country too notoriously unhealthy for unacclimatized white men, every regard to the sanitary arrangements of the army should be carefully looked into, and especially so far as a pure water supply is concerned. The prevalence of fever, and the amount of field service per-

formed by the troops, has several times been pointed out as a well-marked coincidence. The reason of this is not far to seek, but must in the large majority of cases be put down to the impurity of the water which the men on active service are compelled to drink. Attention was drawn to this matter in the *Medical Record* of a recent date. This danger of contracting fever from this cause might be greatly lessened by providing portable water filters for troops operating in the field. At such times the men are dependent upon surface-water supplies, and it may be said that surface-water supplies are always dangerous. Dr. Smart, in a communication to the office of the War Department in July last, discussed this subject and in the course of his remarks said: "I desire to point out that in the early days of the settlement of our Western country fevers were common, both in military commands and in civilian communities. These fevers were of an adynamic type. By some observers they were regarded as malarial remittents, by others as specific typhoid fevers, while others again, among whom was myself, considered that although the majority of the cases were of malarial origin, occasional cases were due to the specific cause of enteric fever, either developed *de novo* or propagated from some previous cause. Notwithstanding differences of opinion as to the nature of the fevers, there was a general belief that the water supply was concerned in their causation. This belief became strengthened as continued observation showed that these fevers diminished in prevalence both at military stations and in civilian settlements as purer water supplies were obtained. The advisability of providing pure water for troops in the field may be considered evident. The possibility of making this provision seems to have been hitherto an untried experiment, at least in this country." It is impossible to gainsay the truth of these words, and at this juncture they should have special weight, for in the case of hostilities being carried into Cuba, it is more than probable that those engaged in fighting would have as much to fear from disease as from Spanish bullets. Therefore it will be judicious to take every possible precaution.—*Medical Record.*

FIELD FIRING IN RUSSIA.

General Dragomiroff has been exercising the troops under his command in the tactics of the three arms. A company of fifty files was ordered to fire on two batteries, represented by dummies, at distances of 840 and 500 saschen respectively (saschen being 2.13 metres). The firing was to continue for three minutes, and the distance was unknown to the company. At the first-named distance twelve volleys were fired, in all 1296 rounds, resulting in ten men of the battery being hit. At the second distance ten volleys consisting of 1080 rounds were fired and twenty men were hit. A battery was then ordered to fire, at the same distances, on two half companies, made up of a hundred dummies in single rank with intervals of a quarter of a pace. At the first distance (840 saschen) forty-six shells were fired in three minutes, ninety dum-

mies being hit, the number of hits being in all 335. At the second distance sixty-four rounds were fired in 3½ minutes, ninety-seven dummies were hit, the number of hits being 718. An attack was afterwards ordered on a battery and a troop of cavalry represented by dummies; but the number of hits was almost *nil*, and the cavalry and artillery did not keep up the required combination.—*Militar Zeitung*.

RUSSIAN MILITIA.

The Russian militia is called out for training once a year for a period of four weeks, and the authorities choose the season of the year when the men can best be spared from their ordinary employment. The militiamen are housed in the barracks of the Government district in which they train, or in buildings taken over for the purpose, and it is seldom that they are lodged with the inhabitants. Their rooms contain the necessary camp furniture, but many of the men, as is usual with Russians on a journey, carry with them their own mattresses and pillows. They receive two hot meals daily, each man having at least 200 grammes of meat and 1200 grammes of bread; also tea, either every day or several times a week. The men wear their own clothes during the training, which has not the best effect from a military point of view, and sometimes boots and greatcoats have to be served out from the stores to men who have none. The instruction is carried out under the orders of the commandants of the respective districts, assisted by officers of the army and militia, and consists chiefly of rifle and close order drill.—*Avenir Militaire*.

COAST DEFENSE IN FRANCE.

The recent debarkation of Greek troops in Crete, the blockade of that island, and the threat of a still more strict blockade of the Piræus by the international fleet, says the *Revue du Cercle Militaire*, teach us valuable lessons. They show that we should carefully provide for the defense of our sea frontiers. The Chino-Japanese War had already given us food for reflection. The sudden invasion by the Japanese and their prompt successes were due to debarkations which were ably conceived and boldly executed; but instead of taking warning we merely remark that French soldiers are different from Chinese, and with that comforting assurance we continue to indulge in a false security. The military authority cannot alone cope with this question, and in France the reform of existing systems, or the introduction of any new organization, is attended with difficulty and delay. Many of our politicians question the need for expenditure on coast defenses as well as on ships-of-war. Other nations are, however, of a different opinion. England, Italy, and Germany are several years in advance of us, and set us an example, in the matter of coast defense. Although an attempt was made by means of the decree of February 20, 1894, to provide for this, the dual arrangements of the naval and military ministries are complicated and unsatisfactory. In the next war, its theatre will be not only on land but on the sea and

on our sea coasts; and as our fleet is not strong enough both to fight at sea and guard the coast; should we not fear lest our dockyards and harbors may be reduced to heaps of ruins? If, for instance, one or two army corps were debarked on our soil at a time when all our land forces were concentrated on the Vosges and the Alps, the result would be to divide our strength and absorb the supplies on which Paris would depend for its existence. The whole district between Paris and La Manche is rich in produce, and it is on the opposite side of the country to that traversed by our mobilized armies. Paris would, therefore, depend on it for supplies, but the destruction or occupation of Havre, or the incursions of an enemy into Normandy, would compromise the food supply. The intrenched camp of Paris would require for its 3,000,000 mouths 1,500,000 kilogrammes of bread per day—equal to 360,000 cwts. of flour per month, or 2,160,000 cwts. of flour for six months. For a siege of six months there would also be required 732,000 oxen and 4,223,076 sheep. Dependence should not be placed on preserved meats, which are productive of disease. A permanent consultative committee on provisions was formed in 1889, and the quantity of victuals to be brought into Paris in case of war is known and fixed; but whence are these to be drawn? Certainly not from the north, nor from the east, nor from the south-east, which will all be occupied or traversed by our armies, and consequently be unable to supply the wants of Paris. The central, western, and southwestern regions of France may be available, but while rendering this service they must be protected against invasion. To collect the necessary quantities of corn and cattle in depots to await transport would require several days—how many it is difficult to say, because after contracts had been made, the mobilization would probably withdraw the greater part of the men and horses from civil employment. The next difficulty is that of transport from the depots to Paris. This would require 169,164 trucks, making 3750 trains, and it would be difficult to find so many trucks and engines to draw them. Taking the highest number of trains practicable when all works smoothly from beginning to end, namely, five in the hour or 120 in twenty-four hours, it would be thirty-two days before Paris could be provisioned by the agency of one railway company, and if three companies undertook the work it would be done in proportionately less time. It is, however, found in practice that to keep up the above number of trains is impossible, and that one-fourth of that daily number is nearer the mark, large margins being required for delay and contingencies. It may therefore be safe to say that if three railways were employed in provisioning Paris the work might be accomplished in forty-four days, but all this would be utterly impossible during a concentration of armies, when, of course, troops must be pushed on whatever trains are left behind, and so if Paris is not supplied before mobilization it must wait for about a fortnight—until the confusion is over. Then it may be done if the southern and western region remain open for two months after a declaration of war, but if not it

cannot. It is probable that we should soon be largely dependent on seaboard provisions, not only for Paris, but for the army and the nation. This shows the imperative necessity of preventing the enemy from destroying or blockading our ports, or even of attempting to land on our shores. The defense of our coasts cannot be too urgently and persistently advocated.

The Minister of War has decided on the abolition of the present forms of shelter-tent, and the introduction of a new pattern. This will gradually take the place of the old patterns as the stock of the latter in store becomes exhausted. The material of the improved *tente-abri* is ordinary cotton, stained and water-proofed; the supports are of bamboo, in four lengths, each end being strengthened with brass fittings. The pickets are of mild steel, in the form of a screw tapering to a point, and the ropes are of the best French hemp. The sides of the tent are 1.60 metres in length, and the weight of the whole complete is 1 kilogramme 76 grammes. This is 464 grammes higher than the Waldéjo tent hitherto used in the service.—*Revue du Cercle Militaire.*

THE CROSSING OF RIVERS IN RUSSIA.

The Niemen, about two miles above Kovno, was crossed during some manœuvres, by two Russian regiments of dragoons, the 8th Smolenski and the 9th Elisabethgrad. At ten o'clock in the morning a line of chasseurs-à-pied in skirmishing order, occupying the right bank, opened fire on the dragoon squadrons, which were approaching the left bank to cross the river at a point indicated. The Smolenski dragoons, who were at the head of the column, immediately detached some dismounted men to line the left bank and silence the enemy's fire. According to the idea of the manœuvres, the cavalry were to seize the boats necessary for the transport of arms and baggage, and these boats were on the right bank, and protected by the enemy's skirmishers. The scouts at the head of the regiment rapidly undressed, retaining only their sabres, and unsaddling their horses, with which they dashed into the river, swam across, covered by the fire of their skirmishers on the left bank. In two minutes and a quarter the leading men had crossed the Niemen, which is here over a furlong wide, and, charging the enemy, forced him to mount and retire. The captured boats were then despatched to the left bank, where they were loaded with clothing, equipment, arms, and ammunition. The men of the 8th Smolenski then swam the Niemen, while the horses, which made no difficulty about entering the water, were taken over in batches by such of the men as were specially good swimmers. The Elisabethgrads, headed by Colonel Zaroubine, chief of the staff of the 3d Division of Cavalry, followed in similar fashion, the squadron officers also swimming across at the head of their men. The sappers of the engineer company stationed at Kovno then ferried across the ammunition wagons of both regiments on a couple of rafts made of light timber beams, thus completing the operation without accident of any kind, to

the entire satisfaction of the commanding general. It only remains to add that eight rowing boats had been previously disposed across the river a little way down stream, so as to be able to render prompt aid in the event of anything going amiss during the passage of the river. However, they were only called upon to render a little assistance to a few of the troopers who got separated from their horses.—*La France Militaire.*

NUMBERS IN WAR.

An Austrian officer has written a work entitled "Numbers in War," in which he discusses how wars will in future be commenced, with what fighting strength they will confront each other, what will be the importance of numerical superiority, how long campaigns and battles will last, and what will be the probable losses, owing to the modern weapons of artillery and infantry. The author is of opinion that some powers would not scruple to begin hostilities without any formal declaration, in order to obtain the advantage possessed by the offensive over the defensive. Future wars will be waged by "armies of masses." Russia has 2,500,000 soldiers; Germany, 2,300,000; France, 2,200,000; Austria-Hungary, 1,300,000; Italy, 800,000. France and Russia could, therefore, bring 4,700,000 men against the 4,400,000 of the Triple Alliance. If the chief campaigns of the century be examined, it will be found that in forty cases against six the victory was due to superior numbers. That is the first and last chance of success in war; not, of course, absolute superiority at all times, but at the critical time and in the desired place. The art of obtaining this superiority should be possessed by the commander-in-chief. It is, however, quite understood that numbers without sufficient instruction and equipment are worthless, as was proved in the second period of the Franco-German War. Allied operations are only desirable when the allied armies are under one commander. There is no prospect of shorter wars in the future. The author cites instances of successes gained by young generals, whom he seems to prefer, especially for cavalry, to those of more mature years. With regard to losses in war, it is stated that during the Franco-German War 500,000 German soldiers were sick and only 88,000 wounded. On the subject of fortresses it is asserted that, with few exceptions, all the important sieges of the century have ended in the reduction of the place, but in many cases they had a great influence on the general conduct of the war. Losses in battle fall nearly as heavily on the victor as on the vanquished—a statement supported by abundant statistics in this work. There may be more terrible scenes at particular spots on a battle-field, but the percentage of loss on the average will not be greater than in the wars of this century. Speaking of marches, he says that no modern army could march with the rapidity and endurance displayed by Napoleon's troops, but that future wars will probably be characterized by rapid operations. His calculation is that an average loss of 10 per cent. is due to marching. In the 10th German Army Corps and in the Guards

the loss from this cause amounted to something between 8 and 10 per cent. a few days after the commencement of the war.—*Revue du Cercle Militaire.*

GENERAL DRAGOMIROFF.

General Dragomiroff has been giving expression to his views on the great wars of the past in a Russian journal. He says that the soldiers of to-day require to be educated up to the point of self-sacrifice, because it is always possible a time may come when they must either face the probability of death or be guilty of cowardice. Losses from hostile fire may and ought to be reduced to a minimum, but the fact should not be forgotten that war is made not so much to avoid losses as to gain certain ends. Stories of showers of bullets are generally got up for the benefit of soldiers who do not perform their duty on the field of battle. We should always remember that the enemy does not monopolize the firing, and that we take our part in the game with him; further, that of two adversaries the victor will be, not he who has the best rifle, but he who shoots best and is least anxious about the safety of his own skin.

Engineers have begun to take levels for the construction of the railway which has been projected between Merv and the military post of Konchk on the Afghan frontier. Thence there will, as soon as this line is finished, be direct communication with the Caspian Sea, and consequently with the rest of Russia. It will be known as the Mourghab branch, its length will be about 317 kilometres, and its cost, including rails and rolling stock, will be a little over 8,700,000 roubles. There will be seven stations on the line, namely, Sary-Yazy, Kapterkhan, Sultan-Bend, Imambaba, Tach-Koupri, Kalkh-i-Mor, and Kouchk. It is expected that the work will be finished in three years. It is also calculated that during the present year the Samarkand and Andijan railway will be completed, including its Tachkent and Marghilan branches.

A reaction has commenced against the disadvantages connected with the present mode of instruction in equitation. It is true that the winter is fully occupied in forming the young cavalry soldier, and the ancient feats of show horsemanship have been abolished, their place being taken by a really rational and practical equestrian education. Further facilities are, however, required. All the work of the winter would be better done if reëngaged under-officers were employed as rough riders. Other armies do not hand over their young horses to any but expert and experienced men. Three years may be enough to make a trooper, but not to make a rough rider. Another improvement asked for is that covered riding schools be provided, instead of open *manèges*, in which the cold and snow prevent both the instructors and the men from doing their duty as it ought to be done.—*Revue du Cercle Militaire.*

Comment and Criticism.

I.

"Our Volunteer Armies."—A Reply.

Lieut. S. M. Foote, U. S. Artillery, Prize Essayist.

IN the March number of the JOURNAL there were a number of comments on my essay "Our Volunteer Armies," which appeared in the January number. I wish, in the first place, to thank the critics for the courtesy which they have shown, even where they have differed most from my views. Without going into a detailed answer to the criticisms offered, there are several points upon which I would like to make a few remarks.

As to Colonel Hitchcock's plan for 300,000 National Guard of the United States, involving the expenditure of $20,000,000 annually, it would give us an efficient force, no doubt, but the expenditure of such an amount of money was entirely above and beyond my contemplation.

Colonel Edmands, Colonel Alexander and Colonel Pfaff all criticise my statements about the militia as heavy artillery. I said in conclusion on that subject: "It is not believed, therefore, that the general government can place much dependence upon State help in time of peace toward providing a force to man our fortifications." I had just referred to the solitary heavy artillery militia regiment in all the United States, and what I said was with that in mind. There is no doubt that militia *can* be made effective as heavy artillery, if they choose to take it up and stick to it as they have done with Lieutenant Weaver in Boston. Lieutenant Weaver's article shows it can be done—a fact which I never denied and never doubted. But the fact that there are only about 700 militia heavy artillerymen out of 115,000 militia—or one regiment out of about 150—in a country with twenty-six principal harbors and a coast line of over 3000 miles, is believed to be sufficient ground for the statement above quoted.

Colonel Edmands suggests what he calls "something feasible" to take the place of the plan I proposed. But as far as any plan or system for raising volunteers is concerned he leaves matters in the end much as they are now. He proposes an increase in the Regular army and its distribution among all the States—one regiment of infantry to each State, etc. "That would mean a Regular army of one hundred thousand men. This agrees with Lieutenant Foote's ideas as to the necessary army increase, if not with his disposition of it." I should not agree to any such disposition of it. There is enough local politics, enough log-rolling, in the country now. Let one element of the Government, let the army at least, be free from politics. Just as soon as you localize the Regular army in any respect you introduce local politics, which, instead of striving for the good of the whole army, naturally follows the usual course of local politics, and strives for some benefit to the local regiment at the expense of the rest. Colonel Edmands says: "The regiments so assigned would become in a measure identified with the States, and the people in the States would see to it that their regiments had what was due to them. Such a scheme is not utopian. It is practicable like

the results it might bring." And what would be some of those results? To take the command of the army away from the President and the Commanding General and give it to the politicians. To make the army a political machine. To justify the belief that some people are already beginning to have "that the first requisite for a good army officer is not that he should be familiar with his profession, but that he should be a good politician." No, it is our duty and our pleasure to affiliate with the militia and to assist them in military matters in every way we can, but let army officers perform their duties of whatever nature without fear or favor, without temptation to political truckling, and free from political duress; and let the Regular regiments remain, as far as possible, untrammeled by local attachments and political influence.

I am afraid Colonel Edmands didn't pay me the compliment of reading my essay very carefully, for I did not suggest any such idea as he states as to the necessary army increase in time of peace. According to present conditions, I don't believe we need a standing army of 100,000 men. If we had one thousand to each two millions of population, with power in the President to increase to one thousand to each one million of population, it would be large enough to serve every purpose in time of peace, and on being expanded to double maximum peace strength in time of war and properly distributed, would serve our purposes even then.

Colonel Edmands also says: "But the principal defect in his suggestion is its great expense in details overlooked by him, such as armories and drill-grounds (very costly affairs), together with general equipment." What do the volunteer officers proposed want of armories? When they are called out for ten days' service they are to live in the field. They are supposed to know about everything of military value they would learn in an armory before they can get into the volunteers. As for their general equipment, that would be valuable property in the hands of the United States, and such as they ought to have on hand whether any such organization as this existed or not.

The burden of the comments is devoted to the position of the National Guard in our military system. This is a subject which I discussed at some length in the essay, pp. 37 to 41 and p. 45, JOURNAL for January, 1898.

General Bend says: "It seems to me the National Guard has all the necessary elements to make such a force as we should have, and that no plan can be as good as one based on this theory." He does not state what these elements are, but immediately suggests that we do away with the State troops entirely, and have in their stead a *United States* National Guard by mustering these same organizations into the United States service. Why make the change? Such an idea entirely subverts the spirit if not the letter of the Constitution. Instead of giving the President power to call out the State troops, it gives the governor power to call out United States troops. I doubt if the general himself would seriously consider such a proposition politically practicable or in any way desirable.

Colonel Edmands says: "For the infantry in our volunteers, we should, in spite of his doubts, have them [accomplished drill-masters and disciplinarians] ready at hand at the outbreak of war." I should like to know the names and locations of the regiments and to see the rosters of the officers. The question is not "Are there enough educated soldiers in the country to furnish officers for the volunteers?" I might perhaps agree with Colonel Edmands, Colonel Cole and the others as to that. What we want to do is to pick them out, desig-

nate and assign them in time of peace. Then, and not till then, will they be "ready at hand" at the outbreak of war. Surely no injustice is done to anybody in suggesting that these men be selected deliberately and carefully, while there is plenty of time, and that some special instruction be given them by professional soldiers.

I am being constantly asked in these times, "If there is a war I want to volunteer. How am I to do it?" What can I say? Simply this: "There is no method laid down by which volunteers are to be enlisted. You must find out when the time comes. There will be people raising companies and regiments. You may take your choice and enroll with one of them." Such a condition of affairs is discreditable to the nation, especially when it can be remedied so readily and at such small cost.

The organized militia has changed greatly since the Civil War, as I said, but its nature, its *genus*, its status as a military force, has not changed. That was fixed by the Constitution and can be changed only by changing the Constitution. Nearly all the perplexity and difficulty that have arisen with regard to the militia have come from trying to make it do someching it was never intended to do—namely, carry on war.

From Washington's time down to the present, statesmen of high and low degree, in Congress and out, have been trying to frame a law that would make the militia serve as a cheap substitute for armies raised and supported by the general government. They have not succeeded, and it seems imposible that they should succeed. But that is no reason why Congress should not pass a law that shall be strictly within the Constitution, providing for organizing, arming and disciplining the militia; and providing for inspections to see that these provisions are complied with.

It is not the business of the States to maintain troops solely for the national defense. Let them do as they always have done, maintain as many troops as they need for purely local purposes, the general government contributing an amount commensurate with its interest in having the troops maintained, on account of their liability to serve the general government in certain emergencies, and on account of their being a training school for volunteers.

Why should people, in the National Guard or out of it, seek to change its status from that of a State to that of a National force? I believe that much can be said to show that the original idea of the founders of our government is the best. That we should have two forces, a National force and a State force; the National force to consist of two parts, the standing army and the volunteers; the standing army to contain all the active professional soldiers in the country, to act as a national police force and military school in time of peace, the nucleus of our armies in time of war; the volunteers to be organized in skeleton form in time of peace, the officers of the organizations being in the service and under pay only so long each year as is absolutely necessary to fit them for their duties in time of war; the organizations to be filled up only for war purposes, the men to be mustered out after the war is over. The organized militia to be a State force, serving the same purposes in the State that the standing army serves in the United States, with the privilege of volunteering as an organization in time of war if they choose to do so.

When a State has a greater difficulty requiring the use of military force than it can handle it calls on the general government for the aid of the standing army, and when the general government has a greater difficulty in the way of

executing the laws of the Union, suppressing insurrection or repelling invasion than it can handle it calls on the State troops.

But the States as such have nothing to do with war or peace. All powers pertaining to such matters belong exclusively to the United States Government. Yet it is a foregone conclusion that the Government will never maintain either a standing force or a reserve force large enough for war purposes. How then shall we be prepared for war? In time of peace we shall probably never be prepared for war. The best we need hope for is to be prepared to prepare. And to this end it behooves the general government to give liberal aid to the State troops, as training schools for volunteers, and as forming with the standing army the first line in case of widespread insurrection or foreign war.

I have been accused of injustice to the militia, but as to this I beg to insist most emphatically that the critics are entirely mistaken. According to the scheme that I proposed the requirements for a commission in the volunteers would include practical and theoretical knowledge of military matters that can be obtained only in military organizations or military schools, resulting without doubt in a large majority of the officers of volunteers coming from the militia. This fact alone would show the general government the practical benefit of the State troops to the nation, and would soon result in securing them a million dollars annual appropriation.

Consider the state of affairs at this writing when we are on the eve of what promises to be a war with a second class European power having a navy much weaker than ours. It seems to be the impression that the Regular Army and volunteers from the National Guard together will give us sufficient military strength, so that we shall not need to call out any other volunteers. But suppose things should take a different turn and a call should be made for large numbers of volunteers? What a scramble will take place for the offices! Who will get them? Aye, who? The most efficient military men in the National Guard or elsewhere, or military tyros popular with the boys or having a good pull with practical politics? It cannot be denied, in the light of our history, that the latter would stand almost as good a chance as the former, to the great detriment of the military service. Suppose, however, the plan I proposed were in force at this time. The place of every man would be known, and any militiaman who was also an officer of volunteers would have several men in training to take his place if he had to leave the militia. Every captain of volunteers would be known and would doubtless by this time have on his rolls the names of enough men to fill up his company. Nay, they would probably be drilling already. If the call should come they would be all ready to be mustered in and with an efficient complement of officers.

For the organized militia as a whole, and especially for the well educated and ambitious younger element individually, the enforcement of the plan I have proposed would be the best thing that ever happened.

II.

United States Guard, Why Not?

Colonel C. W. King, Iowa N. G.

"I CANNOT help plead to my countrymen, at every opportunity, to cherish all that is manly and noble in the military profession, because peace is enervating and no man is wise enough to foretell when soldiers may be in demand again."—SHERMAN.

The nobility of those words of our immortal Sherman, pregnant with pro-

phetic truth, has inspired the patriotism of thousands, and may it ever remain as the opening paragraph to each number of the MILITARY SERVICE INSTITUTION JOURNAL.

In reading the Prize Essay of Lieutenant Foote, and after having read of many other most interesting plans for organization of the army and volunteer forces of the United States, and spent much time in thought on it, the writer has determined to offer what in his humble judgment would seem consistent as meeting some of the many objections which are argued pro and con with relation to the best method for raising and maintaining a volunteer army. It is expected that there may be objection to what is offered here, for who is so "wise in his own conceit," but that there be another more wise than he, albeit?

There is much ground for serious reflection in the effort to create a volunteer addition to the Regular establishment. The National Guard organizations have in purpose, at least, the same objective as all others proposed. Is it not true that the last few years have brought officers of the Army and National Guard in closer touch than was generally felt between the Regular and volunteer officers prior to the time providing for details from the United States Army to National Guard encampments? At least it is safe to say that where they have been affiliated, the cordial relations begun should be continued, and it is my humble belief that the wisdom and abilities of our fellow-officers of the Army will work in harmony with the Guard officers, and our nation some day will view with pride a great army made up of the nucleus of the Regular and volunteer State troops combined. The National Guard is so far advanced in name and proficiency that it might seem idle to suggest a name which would imply what would seem agreeable to the Regular army and the States of the Union, which have not quite as many designations for the State troops as there are States in number. If Congress, in enacting a revision of the old militia law, should decide upon having an organization in touch with modern advancement in military science, would not the name *United States Guard* be most appropriate for the organized militia? There is one condition which will remain a stumbling-block to prevent legislation and reorganization as long as individuality is adhered to in the discussion of plans for such, and that is the absence of unity among military plan inventors which does not appeal to the good sense of our legislators. Another is, that every new scheme, or old one revised, carries with it the need of an appropriation which is usually in amount greater than legislators looking through political eyes can see the need of. And, here comes another plan, and, if there be in it that which may serve the purpose in any way, the writer will rejoice for "the general good."

In the event of war who would deny the right, and who would not in conscience concede, that our generals and field officers in line of command of the United States Army should command the armies, corps and divisions of such troops as the United States might put into the field? In an army of half a million, each colonel, lieutenant-colonel and major of the United States Army could become a division or brigade commander; the forty senior captains could advance to the command of the Regular regiments, the next forty to the grade of lieutenant-colonel one hundred and twenty to the grade of major, and advance the remaining two hundred and eighty (figuring on twelve company regiments) two hundred files, and advance at least two hundred first and second lieutenants one grade in the United States Army, not to consider those who could be permitted to take volunteer positions.

The plan here suggested would contemplate an Act of Congress to revise our militia laws and make a sufficient appropriation to require that such States availing themselves of the benefits of it would be required to muster into the *United States Guard* all of their organized volunteers, who should take the following oath:

"I,....., do solemnly swear (or affirm) that I will bear true faith and allegiance to the United States of America and the *State of*.....; that I will serve them honestly and faithfully against all their enemies whomsoever; and that I will obey the orders of the President of the United States and the *Governor of*.....; and the orders of the officers appointed over me, according to the Rules and Articles of War." (Oath as per A. W. 2, except underscored.)

The United States Guard could be numbered from one to as many regiments of artillery, cavalry and infantry as there would be mustered into the service and assigned to the various present departments of the United States Army, to be assigned to brigades and divisions by the department commander, who could be commissioned by the President, Lieutenant-General, of the United States Guard (the Commanding General of the Army to be General of the United States Guard). Upon recommendation of the department commander the President could commission such officers (the field officers of the line in the department) as the department commander would nominate as major and brigadier generals of the United States Guard, who would be assigned to the command of the divisions and brigades by the department commander. Each division commander could have detailed from the United States Army a captain, to be lieutenant-colonel and Assistant Inspector General of the United States Guard, and each brigade commander have a 1st lieutenant to be major and Assistant Inspector General of the United States Guard. There could be a lieutenant-colonel and Assistant Adjutant General for division commander and major and Assistant Adjutant General for brigade commander from the United States Guard.

The other staff departments could be under the direction of its chief in the United States Army and made to conform to this general plan; the regular complement of aides-de-camp for division and brigade commanders to be appointed from the United States Guard. The pay for all officers of the United States Guard should be the minimum pay of each grade in the United States Army (without fogies) when in actual service in the field or camp of instruction, with 10 per cent. additional for each year or part thereof, over six months, for actual war service.

Such officers of the United States Guard who would serve upon the staff of a general officer of the United States Guard should be on duty with and where such general is stationed, according to the need of his department; officers of the Adjutant-General's Department would of necessity be on constant duty. Those of the Quartermaster and Subsistence Departments would be required whenever troops would be moved, at camps of instruction and during the winter for at least two weeks' instruction. Officers of the Small-Arms Practice Department should be on duty during the practice season, going from station to station directing the work in this most important department. Medical, Engineer and Signal departments should be correspondingly used in a manner also to obtain instruction and practical knowledge at such seasons of the year as would prove of most advantage. Whenever justice is required or court-martial

necessary to enforce discipline, the Judge-Advocate's department should be used. A great deal of good instruction in military law could be imparted during the year by competent judge-advocates, and there should be none such who are incompetent to perform such duty. There are some officers of this department, as well as others in the National Guard, who are unaware of the requirements of their office.

The matter of transmitting official business between the different departments and the Adjutant-General's Office of the State in which the troops belong, would be a matter of detail very easily adjusted.

The adjustment of the proper organization of the present number to permit reasonable expansion is suggested as follows:

1st. To increase by recruiting the present State troops, about 115,000×4= 460,000. This, in most States, would only double what a maximum regiment, three battalions, twelve companies, twelve squad companies, would be, and hence would only double the number of officers required for a force four times the size of the present number of officers and men now in service of the States. It would require twenty per cent. of the maximum company organizations for the officers and non-commissioned officers, hence but a small per cent. of the present force would remain privates.

2d. Advancement to the rank of colonel could be the limit of authority to be commissioned by other than the President. The grades of brigadier and major-general commanding troops could be reserved for officers of the Regular Army of the line of command, above and including the rank of major of the United States Army; except where volunteer officers have such rank, they should be rendered supernumerary and await appointment by the President as a brigadier-general after those eligible from the United States Army are provided for at the time of organization, and thereafter; a major of the United States Army to be eligible to appointment to the grade of brigadier-general of the United States Guard according to date of commission as major of the United States Army with and according to date of commission of a colonel of the United States Guard to be a general officer of the United States Guard.

3d. A reserve battalion for each regiment should be provided for by detail of officers by the colonel, from the regiment immediately upon call to active service, to be maintained as long as the regiment is in the field, the detail of officers to be changed when desirable from time to time. The ranks should be kept filled in the field from the reserve battalions, thus enabling a regiment to have at least one thousand men present for duty, excepting such times as great casualties would reduce them below an expectancy.

For peace organizations, the three battalions of four companies should be the regiment for the three arms of the service. The infantry company should consist of at least seventy-four officers and men, not including cooks. The eight squad company could easily be enlarged, as a rule, to twelve squads for which arms and equipment should be supplied by the Government and held in readiness at a depot at a strategical point centrally located for the regiment or brigade, and accounted for by the Quartermaster Department, the efficiency of which is obviously necessary.

The Hawley Bill, Sec. 392, "To promote the efficiency of the Militia," if revised, as indicated in the accompanying copy of it, would, with a few additions, as are indicated in the foregoing suggestions, make a very acceptable "Militia Law," in the humble judgment of the writer.

Expand the army to 50,000 and effect the organization of an United States Guard 200,000 strong! Then if we are led by those who are trained and tried, whose minds and thoughts are schooled by experience, we, with an abundance of patriotism, may "aid the enterprise," but we are dependent upon professional example and skill, hence the importance of pulling together, as on us united the life of our nation may soon depend.

A law of the nature here suggested provided in time of peace would give the nation an army in time of war of a quarter of a million of men of the best material and efficiency possible without having a standing army much larger than that we have at present. It would enable us to place the "first line" in the field with the best officers the nation affords, and would eliminate the possibility of having a very large percentage of "political generals." It would enable us to have reserve recruiting battalions at home actively preparing men to go into the ranks at the front, allowing a healthy growth of officers in the field, after having shown their valor and efficiency, to assume command of troops as they report for service from the different recruiting rendezvous. Then if new regiments are required, let them be formed under the direction of the department commander, or some officers designated by him. There need be no fear but that regiments thus formed would be ably commanded by men tried under fire, and not selected from the gilded stump. Lieutenant Foote has well said, "One of the most striking features of the conduct of the war [of Secession] is that often the acts most to be condemned from a purely military standpoint are most to be commended from a political standpoint." What have we to guarantee that the situation would be much changed were we to have a war to-day? "The signs of the times" would seem to indicate that war is among the possibilities, so let us delay no longer, but pull together on some comprehensive plan for the betterment of the service.

55TH CONGRESS,
1ST SESSION.

S. 392.

IN THE SENATE OF THE UNITED STATES.

MARCH 16, 1897.

Mr. HAWLEY introduced the following bill, which was read twice and referred to the Committee on Military Affairs.

(With revision corrections by Colonel C. W. KING, Iowa N. G.)

A BILL

To promote the efficiency of the militia.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That the militia shall consist of every able-bodied male citizen of the respective States, Territories, and the District of Columbia who is more than eighteen and less than forty-five years of age, and shall be divided into two classes—the organized, to be known as the United States Guard in the State, Territory, or District of Columbia, and the unorganized, to be known as the Reserve Militia.

SEC. 2. That the Vice-President of the United States, the officers judicial and executive of the Government of the United States, the Members and officers of each House of Congress, persons in the military or naval service of the

United States, all custom-house officers, with their clerks, postmasters and persons employed by the United States in the transmission of the mail, ferrymen employed at any ferry on a post road, inspectors of exports, artificers and workmen employed in the armories and arsenals of the United States, pilots, mariners actually employed in the sea service of any citizen or merchant within the United States, and all persons who now are exempted by the laws of the respective States shall be exempted from militia duty, without regard to age.

SEC. 3. That the United States Guard shall consist of such regularly enlisted troops as are or may be organized in, and officers duly commissioned by the President, or by the governors of, the several States, Territories, and the District of Columbia, in pursuance of this Act: *Provided*, That an original enlistment shall be for not less than three years, and a reënlistment for not less than one year; and if such enlistment shall expire during a time when such troops shall be in the service of the United States it shall continue until the expiration of the time for which they are called into such service.

SEC. 4. That the reserve militia shall be subject or liable to any military duty to the United States when called into service by the President or by Act of Congress passed for that purpose. The United States Guard shall be subject or liable to any military duty to the United States when called into service by Act of Congress passed for that purpose or by the President of the United States pursuant to law; and every officer and enlisted man of the organized militia called into the service of the United States shall be held to be in such service from the date of the publication of such call; and any officer or enlisted man who shall refuse or neglect to obey such call shall be subject to trial by court-martial, and be punished as such court may direct.

SEC. 5. That courts-martial for the trial of officers or men of the organized or the reserve militia, when in the service of the United States, shall be composed of guard or militia officers only, but such officers need not be residents of the same State or Territory.

SEC. 6. That the organization of the militia and the number, rank, and duties of its staff officers shall conform to the relative rank of the army for the respective States, Territories, and District of Columbia; and that such organization and the discipline of said troops shall conform as closely as practicable to that prescribed for the Army.

SEC. 7. That the adjutant-general of each State, Territory, and the District of Columbia shall perform such duties as may be prescribed by the laws of such State, Territory, and District, respectively, and make returns to the Secretary of War at such times and in such form as he shall from time to time prescribe of the number of the United States Guard, and also make such reports as may from time to time be required by the Secretary of War.

SEC. 8. That the Secretary of War shall, with his annual report of each year, transmit to Congress an abstract of the returns and reports of the adjutants-general of the States, Territories, and the District of Columbia, with such observations thereon as he may deem necessary for the information of Congress.

SEC. 9. That the United States Guard shall be trained in accordance with such systems of drill and tactics as may from time to time be prescribed for the Army.

SEC. 10. That whenever the United States is invaded or in imminent danger of invasion from any foreign nation or Indian tribe, or of rebellion against the authority of the Government of the United States, it shall be lawful for the

President to call forth such number of the United States Guard of any State or States, or of the District of Columbia, as he may deem necessary to repel such invasion or suppress such rebellion, and to issue his orders for that purpose to the governor or governors thereof, or to any officer or officers of the United States Guard for such number of such militia as the President may think proper, and he may in time of peace accept from the governor of any State or Territory such number of the United States Guard as may be offered for the purpose of united instruction and discipline, with or without troops of the regular establishment, whenever proper appropriation therefor shall have been made, and such troops when so accepted shall be deemed to be in the service of the United States during the period for which their services have been required and accepted by the President.

SEC. 11. That when the United States Guard of more than one State is called into the actual service of the United States by the President, he may, in his discretion, apportion them among such States according to representative population.

SEC. 12. That the United States Guard or reserve militia, when called into the actual service of the United States or accepted as provided in section ten of this Act, shall be subject to the same rules and articles of war as the regular troops of the United States.

SEC. 13. That whenever the President calls forth the United States Guard of any State or States, to be employed in the service of the United States, he may specify in his call the period for which such service is required, and the United States Guard or militia so called shall continue to serve during the terms so specified, unless sooner discharged by command of the President, and shall serve wherever ordered, within or without the territory of the United States.

SEC. 14. That the United States Guard or reserve militia, when called into the actual service of the United States, shall, during their time of service, be entitled to the same pay and allowances as may be provided by law for the Regular Army.

SEC. 15. That when the United States Guard or reserved militia is called into the actual service of the United States, or any portion of the United States Guard is accepted under the provisions of section ten of this Act, their pay shall commence from the day of their appearing at the place of battalion, regimental, or brigade rendezvous, and the expenses incurred in moving the United States Guard or reserved militia of any State, Territory, or the District of Columbia to their places of rendezvous, in pursuance of a call of the President, or of the authority of any State or Territory and approved by him, shall be adjusted and paid in like manner as the expenses incurred after their arrival at such places of rendezvous; but this provision shall not be construed to authorize any species of expenditure previous to arriving at the places of rendezvous which is not provided by existing laws to be paid after their arrival at such places of rendezvous.

SEC. 16. That the sum of $10,000,000 is hereby annually appropriated, to be paid out of any money in the Treasury not otherwise appropriated, for the purpose of providing for the issue to the United States Guard through the States, Territories, and the District of Columbia, for the use of the United States Guard, of such military stores and supplies, including blank forms, tactics, regulations, and other books as are or may be furnished by the War Department for the use of the Army. The purchase and manufacture of such stores and sup-

plies shall be under the direction of the Secretary of War in the same manner as those manufactured or otherwise provided for the use of the Army. Such stores and supplies shall remain the property of the United States, be receipted for, annually accounted for, and when satisfactory proof that any such stores or supplies are unserviceable or obsolete shall have been submitted to and approved by the Secretary of War, such stores or supplies shall be turned into the War Department, and thereupon the Secretary of War shall cause such unserviceable or obsolete material to be sold, and will report the amount received therefor from time to time to the Secretary of the Treasury, who is directed to then credit to the appropriation for arming and equipping the United States Guard the amounts so reported to him by the Secretary of War. The Secretary of War, upon receiving notification from the Secretary of the Treasury that the amounts have been credited to the appropriation aforesaid, will credit the respective States, Territories, and the District of Columbia, as the case may be, with the amounts to which each may be entitled.

SEC. 17. That said appropriation shall be apportioned among the several States, Territories, and the District of Columbia, under the direction of the Secretary of War, according to the number of United States Guards in service to which each State, respectively, is entitled, in such proportion and under such regulations as the President may prescribe: *Provided*, That no State shall be entitled to the benefits of the appropriation apportioned to it unless the number of its regularly enlisted, organized, and uniformed active militia shall be at least one hundred men for each Senator and Representative to which such State is entitled in the Congress of the United States; and the amount of said appropriation which is thus determined not to be available shall be added to the annual appropriation for the next ensuing fiscal year and be apportioned as provided in this section.

SEC. 18. That any State, Territory, or the District of Columbia may, with the approval of the Secretary of War, purchase for cash from the War Department for the use of its United States Guard any military stores or supplies, such as are furnished to the Army, in addition to those issued under the provisions of this Act; and such stores, or supplies may, in the discretion of the Secretary of War, be sold for cash to States, Territories, and the District of Columbia at the price at which they are listed for issue to the Army, with the cost of transportation added, and funds received from such sales shall not be covered into the Treasury, but shall be used to replace articles thus sold, and shall for this purpose be available until used.

SEC. 19. That each State or Territory furnished with stores and supplies under the provisions of this Act shall, during the preceding fiscal year, have required every company, troop, and battery in its United States Guard, not excused by the governor of such State or Territory, to go into camp of instruction or be quartered at a United States fort for instruction in heavy artillery, as hereinafter provided, at least five consecutive days, and to assemble for drill and instruction not less than 24 times, with no longer time than 30 days between any two drills, and shall also have required during such year an inspection of each such company, troop, and battery to be made by an officer of its United States Guard or an officer of the Regular Army.

SEC. 20. That notice shall be given the Secretary of War by the adjutant-general of each State, Territory, and the District of Columbia of the time and place of the annual inspection of the United States Guard of such State, Terri-

tory, or District, and thereupon the Secretary of War may detail an officer of the Army to accompany and aid the State inspector during his inspections, and to observe the condition of the troops and property. Such officer shall make a report to the Secretary of War of the condition and efficiency of the troops inspected, and the Secretary of War shall furnish a copy thereof to the governor of the State or Territory.

SEC. 21. That under the provisions of this Act, the Secretary of War may detail one or more officers of the Army to attend any encampment of the United States Guard, and to give such instruction and information to the officers and men assembled in such camp as may be necessary. Such officer or officers shall make a report to the Secretary of War, who shall furnish a copy thereof to the governor of the State or Territory.

SEC. 22. That upon application of the governor of any State or Territory furnished with stores or supplies under the provisions of this Act, the Secretary of War may, in his discretion, detail one or more officers of the Army to report to the governor of such State or Territory for duty in connection with the United States Guard. The officer so assigned shall receive no pay or emoluments from the United States except those of his rank in the Army. All such assignments may be revoked at the request of the governor of such State or Territory, or at the pleasure of the Secretary of War.

SEC. 23. That upon the application of the governor of any State furnished with stores or supplies under the provisions of this Act, in which there is located a United States fort for coast defense, the Secretary of War is authorized to permit any artillery organizations of the militia to camp near or in such fort, and to drill at and with the heavy or other guns forming the armament thereof, for such length of time as he shall deem proper, which time, except in special cases, shall not be less than five consecutive days: *Provided*, That the command of such fort or garrison or of United States officers and troops stationed thereat shall remain with the regular commanding officer of the post without regard to the rank of the commanding or other officers of the militia temporarily so quartered.

SEC. 24. That the troops of the United States Guard camped at any fort of the United States for instruction may expend in firing practice such amounts of ammunition as may be prescribed by the Secretary of War, who shall detail an officer of the Army to supervise the instruction in firing practice.

SEC. 25. That when any officer, non-commissioned officer, or private of the United States Guard or reserved militia is disabled by reason of wounds or disabilities received or incurred in the service of the United States he shall be entitled to all the benefits of the pension laws existing at the time of his service; and in case such officer, non-commissioned officer, or private dies in the service of the United States or in returning to his place of residence after being mustered out of such service, or at any time, in consequence of wounds or disabilities received in such service, his widow and children, if any, shall be entitled to all the benefits of such pension laws.

SEC. 26. That sections sixteen hundred and twenty-five, sixteen hundred and twenty-six, sixteen hundred and twenty-seven, sixteen hundred and twenty-eight, sixteen hundred and twenty-nine, sixteen hundred and thirty, sixteen hundred and thirty-one, sixteen hundred and thirty-two, sixteen hundred and thirty-three, sixteen hundred and thirty-four, sixteen hundred and thirty-five, sixteen hundred and thirty-six, sixteen hundred and thirty-seven, sixteen hun-

dred and thirty-eight, sixteen hundred and thirty-nine, sixteen hundred and forty, sixteen hundred and forty-one, sixteen hundred and forty-two, sixteen hundred and forty-three, sixteen hundred and forty-four, sixteen hundred and forty-five, sixteen hundred and forty-six, sixteen hundred and forty-seven, sixteen hundred and forty-eight, sixteen hundred and forty-nine, sixteen hundred and fifty, sixteen hundred and fifty-one, sixteen hundred and fifty-two, sixteen hundred and fifty-three, sixteen hundred and fifty-four, sixteen hundred and fifty-five, sixteen hundred and fifty-six, sixteen hundred and fifty-seven, sixteen hundred and fifty-eight, sixteen hundred and fifty-nine, sixteen hundred and sixty, sixteen hundred and sixty-one, as amended, and sixteen hundred and sixty-seven, and all acts or parts of acts inconsistent with this Act are hereby repealed.

SEC. 27. That this Act shall take effect at the beginning of the next fiscal year after its passage.

III.

"The New Carbine and the New Target Practice."

Major J. A. Augur, 4th U. S. Cavalry.

CAPTAIN ELLIS' essay, submitted in the JOURNAL of March, 1898, brings before the army, in a well written article, the mooted question of a good sight with wind-gauge for our military rifle and carbine. The question comes down to this stage—those who shoot the guns in favor of a change, against those who do not believe in it (the authorities who give us the arm) as not necessary for battle conditions, hence, they consider we should not use it in peace time when we practice on the target range.

We are supposed to train the men in this the most important of their duties —accurate shooting—during the month or six weeks every year, to teach each man to handle his gun, learn what it will do, where it will hit, and, in each particular case, to find out the personal equation of the man behind the gun. This duty is the most important one the man can learn, and under the old conditions existing this factor was brought to a great degree of perfection, so much so, that a great many, after firing, could call off before the hit was marked, whether it was high, low, to the right or left. This perfection acquired would not interfere in any way with shooting straight to the front, aiming low to hit; on the contrary, this state of accuracy acquired on the range would make them individually and collectively more dangerous to an enemy. Then, we heard no complaints, nor any fears expressed that in actual battle the men would do poorer shooting, or be less effective, because they had been using a wind-gauge in practice. If we have the necessary fire discipline, which I believe we have, without a shadow of doubt, we can control the use of the wind-gauge with the same care as we can control the use of the magazine, or firing so many rounds, or volley firing, on the advance As these conditions exist, I fail to understand this hue and cry against a good sight with wind-gauge, especially from those opponents who will not have to do the shooting, as against the will and desire of the combatants, to have placed on the gun a device which they know will increase beyond compare the efficiency of their weapon of defense and offense. The regulations require sharpshooters to be sent out in advance, and also placed where they can do effective shooting at a distance, picking off prominent men, etc. With our new rifle or carbine, sighted as at present, we might just as well send a first, second, or third class man. Why? Because their individual shoot-

ing will, in my opinion, from observation, be just as effective and do as much harm. This for the reason that a man never knows where his gun is going to strike, and barring the difference of one man's ability to determine exactly how far he has to aim off an object to hit it, is the only difference in the accuracy of their shooting, when individual objects are to be struck. The gun will not hit the point aimed at, and this fact is so universal that there comes in some factor, other than personal, to account for it. We are told the sight is so placed as to account for drift at certain ranges. Why is it, then, as regards the rifle and carbine, both with the same twist, other conditions being similar, that the rifle shoots to the left and the carbine to the right? I am free to confess, for one, it is beyond my comprehension. This element has to be taken into account, yet the men attain fair proficiency because on the target range the men by having stationary objects, certain parts of the target or butts, learn to know where to aim with the gun. This does not exist in actual conflict; a man will have to guess, and quickly, with the chance, and a great chance, of not hitting. Such a condition should not exist, and I for one want to see a good sight with wind-gauge in use. It will not interfere with the handling or manipulation of the piece, but, on the contrary, will increase its efficiency and give each man that trust and confidence in his arm which he does not now possess.

Captain L. L. Bruff, U. S. Ordnance.

Captain Ellis' paper upon the subject is very interesting because it presents clearly certain criticisms which have been frequently made upon both the new rifle and the carbine. These criticisms are always valuable, because they call attention to certain defects, real or apparent, which can only be brought out in service, and which if well founded, should be at once remedied.

The principal points brought out in the article are: 1. That the sight is a foreign one. 2. That accurate shooting with the carbine is out of the question. 3. That the arm is essentially a weapon for war and not for target practice. 4. "That the bull's-eye can never be hit with the new weapon by aiming directly at it." And incidentally, 5. That the position of the Chief of Ordnance is wrong in adopting a sight which is unfit for target firing. There are many other interesting points in the paper, but these are sufficient for discussion.

With reference to the sight being foreign, it may be said that we must admit that the nations of Europe devote more time and more money to the study of these problems than we do, and that all these studies are to the end of deciding what is most fit and useful for war. Therefore their decisions on such matters have always been, and should always be, entitled to great respect. When such countries as Austria, Belgium, Denmark, England, France, Germany, Japan, and Russia all agree upon a certain point, as they appear to have done in case of the sight, it furnishes good grounds for us to adhere to the same opinion, till our own experience causes a change.

The second point is that accurate shooting with the carbine is out of the question, on account of the sight, and with this will naturally go the assertion that the bull's-eye cannot be hit by aiming directly at it.

It is thought that the difficulty here can be explained by a little consideration of the following facts. This criticism has been made several times, and generally it is thought, after a rather limited experience with the new weapon. We all know that the bullet drifts due to the rifling, and is also deflected by the wind and other causes, and that unless these are corrected for the shooting

is inaccurate. This correction may be made in two ways. The first way, used on the Springfield rifle, was by the drift slide and wind-gauge. By practice at the range the soldier learned finally that a certain correction would enable him to hit the bull's-eye. It was entirely a matter of judgment with him what correction to make, and as each gun had its own equation, what was correct for one gun was not correct for another. But in time all these points were learned and the result was excellent. Now the second method of correcting these deflections is by practically fixing the rear sight notch, and teaching the soldier to use his judgment in aiming to one side of the target. It is evident that this is a great change in method over the old system, and until the soldier learns to form his estimates by practice, he cannot shoot as well as before. Observe, in both cases the man has to exercise his judgment as to the correction to be applied. As soon as he has learned this, is it not just as easy for him to know that he must aim, say, six inches to the left at 500 yds. to hit the target, as it is for him to know exactly how many graduations to set his wind gauge? And it is also evident that he cannot *expect* to hit the bull's-eye by aiming directly at it, and as soon as he understands the reason, he will not lose confidence in his weapon, but will see that it is obeying the same law that his Springfield did, and that he is making the same correction and for the same reason, but in a different way. Now as to the relative quickness with which a man will learn to shoot by this second method, I think the reports of target practice will show that the accuracy is increasing rapidly, which only shows that the men are learning the new method of correcting for deviations. I have heard personally the same criticisms from captains of companies who were using the rifle for the first season's practice, but I have found that after a little further experience these criticisms cease, and those most heartily opposed to the arm at first have reversed their opinion afterwards. And this leads to the consideration of another question. If the old sight with its adjustments is not objectionable, why change it for the new one? It would be much better, apparently, to start out with the new gun and have the same sight as before to which the men are accustomed. The advantage of the new sight should be great, to cause us to give up all the advantages of the old. I think the advantage of the new sight is sufficiently great because we should teach in peace exactly what we will practice in war. Target practice is only a means to an end. Its object is not so much to make scores, as to give the soldier a thorough knowledge of his weapon, and what it can do. In war the wind-gauge would not be used, as a rule, and its presence gives an extra complication which is liable to get out of order, and a sight out of order is worse than useless. The soldier in actual battle has to depend on his judgment as to range, and deviation. Perhaps he would fix his sight at the proper elevation, but he would hardly stop to adjust it further. In this case the advantage of his previous training would appear, and he would instinctively aim so as to correct for deviation, just as he had been taught on the range.

If it be admitted that the soldier can be trained to correct his aim by the second method, then it does not appear why the carbine should not be a target weapon. As with the old gun, the man of steadiest nerve, best judgment and keenest eye will be the best shot, and there will be gradations according to these qualifications, but I think with a little practice it will be found that the men who were sharpshooters with the Springfield will be sharpshooters with the Cal. 30. It is admitted that the Cal. 30 is not a target rifle in the sense of being provided with all the delicate appliances of such a gun, but a target rifle

cannot be a service arm, and if a man is trained with a target rifle and then has his service weapon for active duty, it is practically giving him a new gun when he most needs his old one. It seems better, therefore, to determine first what are the conditions to be fulfilled by a service weapon, and then teach the soldier to use that with the greatest possible skill he can acquire in time of peace, and hence it seems that the position of the Chief of Ordnance is sound, and is backed by all European experience and practice.

Captain G. L. Scott, 6th U. S. Cavalry.

Replying to the letter of March 5, 1898, inviting criticisms on Captain Ellis' article in the March number of the MILITARY SERVICE INSTITUTION, on the "New Carbine and the new Target Practice," I take pleasure in heartily indorsing Captain Ellis' able article, which I have read with pleasure and profit, excepting the following:—"Troops armed with weapons of which they are suspicious, are already whipped; and in battle it will take but few casualties, few groans from the dying, few glimpses at the bloody dead, to change suspicion into panic and flight and to cause a disgraceful rout to take the place of the expected victory."

While I do not know how all troops would act under the conditions enumerated in the quotations, I do know that my regiment would not act in any such disgraceful manner, even if armed only with "flint-locks" and jack-knives.

While I believe in putting into the hands of our troops the best and most accurate weapon obtainable, I still believe in "the man behind the gun" under all conditions; and if that man happens to be an American soldier, I have an abiding faith in "the man behind most any old gun."

Captain R. C. Van Vliet, 10th U. S. Infantry.

When Captain Mallory reads the excellent article "The New Carbine and the new Target Practice," by Captain Ellis, 8th Cavalry, he will feel well pleased with himself, although it is possible that the originator of the rear sight on the Krag-Jorgensen may not feel so happy.

Capt. Ellis may rest assured that the line of the army is backing him in his remarks, particularly with reference to the rear sight. As a member of the Board for the Revision of the Small-Arms Firing Regulations I can testify that it is no easy matter to revise a manual which has stood the test of years and bring it up to date, when we consider what great changes have taken place in the arm, its flatness of trajectory, its great range and its rapidity of loading. I say rapidity of loading because I understand that a battle belt is being devised by which the magazine will be filled by one movement, the cartridges being held in a clip, and the firing being entirely from the magazine. When we consider that the manual was written for the Springfield 45. with its high trajectory, its low velocity and its comparative slowness of action, it is evident that innumerable alterations must be made, yet it seemed to us that nothing of value in Blunt was eliminated, while Captain Mallory's new ideas were timely and to the point.

I think the most important change is substituting the Figure for the old bull's-eye; when one thinks of its practical nature it seems strange that it was not devised for our service years ago. The evolution of the bull's-eye since I entered the service in 1876 has been remarkable—starting with a black cross

painted upon a 4 by 6 target, never being shot at over 300 yards, it gradually grew into a circular bull's-eye, this again becoming elliptical and finally attaining its full growth in the present target—the full-sized figure of a man. Could anything be more practical than the latter, and is it not particularly beneficial as a method of instructing men to estimate distances.

Like Capt. Ellis I am particularly vindictive against the present rear sight. For about twenty years I have been holding on the bull, now I am trying to hold off, and I find the latter the hardest to do. The line of the army almost to a man condemn this sight, should that not be reason enough for abolishing it—surely the opinion of the men who have to do the fighting should have some weight. I know that they have lost confidence in the gun when it is entirely owing to the obsolete character of the rear sight. It is a matter of record that it has been tested for two years and with thousands of rounds of ammunition, and it has been found wanting. The argument, that it makes no difference in a battle whether a rifle shoots accurately or not and that the only requisite is a flat trajectory, is a very weak one. Yet this must be the theory worked upon in sighting the Krag-Jorgensen.

My ideas of a battle have been shattered; according to some theoretical writings it is not necessary for the guns to shoot straight, men are to be considered as putting up a good fight if they hold their rifles horizontally and not vertically—no sighting being necessary, if it can be thought of in time it might be a good thing to lower the sights as the enemy approaches—before this stage is arrived at slow, methodical volleys are being fired—the range being ascertained from the nearest battery. Now as a matter of fact there are at least six minor combats to one battle, in war, where the individual fighting powers of the opponents are given full swing—where the straightest shooting is going to win, and where, if the rifles are simply held horizontally, the holders will probably not live to fight another day.

The American is strictly an individual fighter; in all our wars, and we have had some good ones—this has been their characteristic manner of fighting, they have all been won by well-aimed individual, killing fire, and this needs a well sighted, accurate weapon. Before the wind-gauge was invented our fighting was done at very short ranges where the lack of it was not felt. Now that the ranges are increased it will be absolutely necessary to use the device if we hope to maintain our high record,

The extended order formation is the one formation above all others for individual shooting, it is a bid for it--yet the adoption of a faulty sight makes a good rifle simply a volley gun and the efficacy of volleys is problematical. It places us in a peculiar position to say the least.

Captain Ellis says, referring to its flat trajectory and range, that we have a splendid war weapon, I add, why not give us a splendid war sight?

1st Lieut. Farrand Sayre, 8th U. S. Cavalry.

Captain Ellis quotes the Chief of Ordnance (report for 1892) as to sights of foreign rifles "that none are adapted for accurate target shooting nor would they prove satisfactory for sharpshooters' use in action," and he (Capt. E.) proceeds to point out the fact that while their rifle sights are satisfactory to them as they are unable to afford the cost of target practice sufficient to make their soldiers sharpshooters, it does not follow that such sights would be satisfactory for our use.

I have not seen this fact stated in print before, and I think the point deserves to be emphasized and enlarged upon.

If our authorities study only European methods and conditions—contenting themselves with doing what European governments do—only not quite so well—they will inevitably lead us into disaster in case of conflict with one of those nations.

European nations can put into the field large numbers of disciplined troops before we can organize and equip volunteers. In a war with a European nation an American general will probably find himself with an army of hastily organized volunteers confronted by a hostile army of Regular soldiers superior in numbers to his own. Our army will clamor to be led forward to victory and our whole nation will demand aggressive movements and speedy success. Upon what can he rely to give him success? At King's Mountain, New Orleans, and Buena Vista our volunteers have beaten superior numbers of foreign Regulars by means of superior skill and accuracy in the use of fire-arms. We have always been a nation of sharpshooters, and an inaccurate rifle or one not "satisfactory for sharpshooters' use in action" is unfit for the use of the American people.

The Europeans who compose the rank and file of their armies have had no opportunities to acquire skill in the use of fire-arms before they enter the army, and their governments are unable to provide them with target practice afterwards. Until recently every American was a lord with an unlimited game preserve within his reach, and a rifle was to him a useful and necessary tool. Sixty years ago every American,—even the banker, the lawyer, and the doctor—had his rifle and he would have been ashamed to be regarded as a poor marksman. Target practice with the rifle and pistol were as popular amusements as tennis and baseball now are and as golf seems likely to become.

As to the idea that target practice is a fad of recent origin, to which Captain Ellis alludes, it is sufficient to say that we are only trying to teach our soldiers to do tolerably well what their grandfathers (if Americans) did excellently.

It is true that the conditions I have referred to have passed away in many parts of the country, but they still exist in others, and there are but few American men who have not practised with fire-arms, and although they do not possess the skill of the last generation, I believe that the clear eye and steady hand which enabled the grandfather to drive a nail with a bullet at 100 feet, together with the faculty of keeping his wits in danger and of thinking for himself at all times (an essential to the value of marksmanship in battle) has descended to the young American; and that he only needs a little practice and experience to make him equal to two or three Europeans in battle, *if* he is armed with a rifle of superior accuracy in which he has confidence.

Our Government—due, I believe, mainly to the efforts of Generals Sherman and Sheridan—has made a liberal appropriation for instructing the army, cadets at colleges, and the National Guard in target practice; may we not expect to reap where we have sown?

Perhaps the most conspicuous feature of the essay in question is the author's reserve in suppressing his own opinion as to the utility of target practice. I think, however, it can be read between the lines.

Major Chester can hardly complain of the author's fairness in finding his theory evenly balanced against what appears to be the opinion of our Government, and which is and has been the belief of almost the whole human race. From the time of the 700 chosen left-handed men of the tribe of Benjamin, who

could "sling stones at an hair breadth and not miss" (Judges 20 : 16) it would not be difficult to multiply instances from the history of all times illustrating the estimation in which marksmanship has been held. Skill with missile weapons is traditional with the English-speaking people, and their history would have been different without that skill. Ask a sportsman what he gets when a covey of partridges rises in front of him and he shoots "at the flock." What is true of the shot-gun at 40 yards is a hundred fold more true of the rifle at 400 yards.

I believe that individual marksmanship has been rendered more valuable than it has ever been, by smokeless powder and increased range and accuracy which may be attained by the new weapon.

Captain Ellis apparently has no fault to find with the new carbine, except that it has no wind-gauge, and he has only words of praise for the new target practice. Experienced men can learn to obtain fairly good results without a wind-gauge. The "buckhorn" sight, in use before the Buffington sight, had a wind-gauge, but it was a very clumsy and inconvenient sight, and, rather than take the trouble necessary to change it, soldiers often "held off."

There is a disadvantage in being compelled to hold off so far that the firer cannot see the objective.

Professional hunters, whose skill as compared with ours is that of the professional to the awkward amateur, commonly "hold off" for both wind and elevation ; but we cannot expect our men to attain their proficiency. I think that better results could be obtained from comparatively inexperienced men, both in target practice and in warfare, with a wind-gauge, as it is easier to cause them to take so many points of windage than to explain to them how much to "hold off." The majority of our soldiers will always belong to this class.

The defects of the Buffington sight are well known, but if we cannot make a sight admitting of as rapid and accurate adjustments as the Buffington sight, and still be as strong and durable as the new sight, where is our boasted Yankee ingenuity ?

Another fault which the new sights possess is that the front sight and the rear sight are too close together, and the rear sight is too far from the eye. I see no sufficient reason why the rear sight should not be some inches further back.

I regret that I cannot concur in the unstinted praise given the new target practice.

It was apparently the object of the board which formed the new system to make our target practice conform to the opinions expressed in our authorized text book on " Infantry Fire ; Its Use in Battle," and they quote in their report the statement that "our whole training is directed towards teaching the soldier to aim at the centre." I wonder if any of the members of the board, or the author of the text book referred to, ever read paragraph 30, Small-Arms Firing Regulations (1889). I wonder, too, if these gentlemen really think that we merely held on the middle of the target and blazed away with the sole idea of trying to hit the target somewhere—anywhere.

I should like to have the opportunity to try to explain to them that, while we did not always hit the bull's-eye, we constantly strove to do so,—that the bull's-eye, and not the target, was the object aimed at,—and that as a rule we aimed at the lower edge of it, and that we merely regarded the target as a convenient background, which caught most of our misses and informed us the nature of our errors.

The old target practice taught us to aim at the bottom of the objective and developed the habit of doing so.

The new system does not, indeed, teach us to aim at the centre but it does teach us to shoot at the head, which is worse. I may indeed add elevation and hold under, but it will be my object to strike about the head—and why not, when there is a reward of 2 for a miss 6 feet high and a penalty of zero for a miss one inch low. The habit of taking too much elevation is probably the worst that a soldier could acquire on the range. It is certainly not advisable to compel them to make two errors in order to arrive at a correct result; if they became hurried they would probably fail to make the regular number of errors. If the board had seriously wished to emphasize the lesson of shooting low, which was taught by the old target practice, they could have accomplished it by putting the figure at the top of the target, or, on a target whose scoring divisions were like those of the Wingate or Blunt targets, by setting the lower edge of the figure at the centre of the target. In the first the fear of a zero, in the second the hope of a 5 would impel men to shoot low.

The new bull's-eye (silhouette) is too large. I thought the elliptical bull's-eyes introduced by Captain Blunt inferior to the old circular ones, on account of being somewhat too large, thus tending to encourage careless aiming at 200 and 500 yards. All that is required of a bull's-eye is that it should be easily seen and a convenient object on which to rest the sights. The smaller it is the more careful will be the aim and the greater the accuracy attained.

The new bull's-eye is irregular in form, thus introducing a confusing chance element. A man's score is no longer directly proportionate to the excellence of his shooting.

But little can be gained by trying to make our target practice resemble battle and our course of instruction is injured by it. If, indeed, a modification of our target practice could make our soldiers brave and steady in battle, it would encourage a hope that some ingenious person would suggest further modifications which would make them more honest, neat, and obedient.

The best way to make men steady in battle is give them superior weapons and teach them confidence in them.

Our volunteers at New Orleans had had no practice at figure targets under conditions resembling warfare, but their faith in their rifles, which they knew how to use so well, kept them steady. If their skill had been "nullified" as explained in "Infantry Fire; Its Use in Battle," the result of the battle would have been different.

Too much prominence has been given to volley firing in the new target practice. I presume this is another concession to "Infantry Fire; Its Use in Battle." A large part of this book is founded on the supposition that volley fire is more effective than individual fire, which supposition I believe to be erroneous. It is opposed to the whole of my experience and observation. I feel positive that it is not true of men possessing skill in the use of their rifles. Of course the importance of rigid fire discipline and economy of ammunition is fully recognized. I object to volley firing on the ground that it is a waste of ammunition. For the commands for volley firing I would substitute the commands for firing one round at will (Par. 176, Cav. Drill Regs.). If the board undertook to make our target practice conform to "Infantry Fire; Its Use in Battle," the only consistent thing they could have done would have been to recommend the discontinuance of target practice. I regret that the kneeling

position has been introduced. A man makes a better mark when kneeling than when standing, and the position is the most unsteady one ever used.

The practice of our expert shots training for competitions has shown that the prone position is the best for skirmishing with the carbine. In the prone position the firer makes but a small mark and can use his weapon accurately and rapidly. The position requires no special skill or practice to learn and a man loses no time getting into it or out of it. I know of no objections to it.

The change from unknown (?) to known distances in skirmishing was a good one, although the change was more apparent than real.

Reviews and Exchanges.

Simplified War Game.*

THAT the War Game is not generally practised among the officers of our service is very true. Why this condition prevails is another question. That the game has not become popular may be due to a variety of reasons. Possibly the fact that the rules and tables that must be mastered by both umpire and participants in the game are very complicated and almost numberless is responsible for the lack of interest heretofore displayed. This reason cannot be urged as an objection to the game in the case now before us. The author of the game strikes at the root of objections when he says: "An affirmative answer should be given to the question whether it would add to the usefulness of the game to be rid of these numerous rules and tables." He says further: "The War Game is then used in three different ways, with more or less extension, according to the end in view:

"1. The strategic game, on a comparatively small map, showing the larger operations, without tactical details.

"2. The game with dice, rules, and computations.

"3. The simpler method on a large scale map, without rules, tables of losses, or dice.

"Every body of officers should use the system best adapted to its end. Whatever the method, its value as a military study will depend largely upon the degree of ability possessed by the director."

It is the third of the above methods that we now have under consideration.

The true value of any War Game lies in the fact that the troop leader is called upon to exercise his judgment and reasoning powers, and also because he may be called upon, and generally should be, to explain fully his intentions, and to give in detail the reasons which governed him in making his decisions. A vital point of importance is that the leader should take a view of the situation as it exists at the time, and all his movements and all his acts should be made under the supposition of actual operations. When our officers become educated up to this view of the game, it cannot fail to prove very beneficial.

Captain Swift, who was formerly in charge of the conduct of the War Game at the United States Infantry and Cavalry School, fully appreciates the difficulties under which the game has heretofore been conducted in this country, and succeeds most admirably in removing them in his translation and adaptation of the author's work.

In the War Game a practical solution of the following problems is given:

1. The formation and order of march of two opposing forces, each containing cavalry, artillery, and infantry.

* *A Simplified War Game.* By General Verdy Du Vernois. Translated from the French and arranged for American Students by Capt. Eben Swift, Fifth Cavalry. Hudson-Kimberly Publishing Co., Kansas City, Mo. 1897.

2. The first contact of the hostile patrols.
3. A cavalry combat.
4. The burning of a bridge
5. A combat of infantry in the vicinity of the bridge and an attempt to force a crossing.
6. The crossing of a stream at a distance from the enemy.
7. The attack and defense of a village.
8. The retreat of a detachment.
9. The pursuit.

"In this way we are able to see all the phases of a complete manœuvre of the three arms combined. The whole is followed by a criticism of the methods pursued and a discussion of other solutions of the problem."

The apparatus for conducting the game is very simple and compact, consisting of a map on a large scale, two small boxes containing blocks, scales, and dividers, and the text-book.

The price, $5.00, places the game easily within the reach of every officer.

FRANK H. EDMUNDS,
Captain 1st Infantry.

Proceedings of the Association of Military Surgeons.*

In these days when the space between "wars" and "rumors of wars" appears to be rapidly diminishing, and when grave possibilities in military surgery present themselves to the mind of every thoughtful practitioner in the country, it is gratifying to receive this report of the transactions of the Association of Military Surgeons, and to note what they have been doing during the "piping times of peace."

The present volume is larger than its predecessors, and like them is divided into sections, each embodying articles upon some one line of surgery or medicine. The scope of the work is well indicated by the headings of these various chapters: Naval Medicine, Surgery, and Hygiene, Military Personal Identification, Clothing and Accoutrements, Military Physical Training, The Military Medical Officer, Sanitary Work in the National Guard, Transportation of the Disabled, Medical Service in the Field, The Service of Aid to the Disabled, Military Surgery, Instruction in Military Medicine and Surgery, Military Medicine, and finally, Foreign Military Sanitary Matters.

Each chapter contains a number of papers, and a person interested in any one of the topics thus indicated will be sure to find helpful and valuable information in the volume. To discriminate among so many papers that are valuable is a difficult task, but attention may be directed to a few articles which may be taken as types of the general series.

Col. C. A. Siegfried, U. S. Navy, writing upon the "Work of the Medical Department on Board United States Naval Vessels," gives to the civilian a most excellent epitome of the conditions there existing. When it is remembered that the modern war-ship is essentially a fighting machine, and that the provisions made for the surgeons and their possible patients are notoriously inadequate, and when the inducements to join the navy are so few that great difficulty is experienced in securing a sufficient number of surgeons to fill vacancies,

* *Proceedings of the Seventh Annual Meeting of the Association of Military Surgeons of the United States.* Held at Columbus, Ohio, May 25, 26 and 27, 1897. Edited by James E. Pilcher, M.D. 8vo, illustrated, pp. 700. Berlin Printing Co., Columbus, Ohio. 1897.

it is a matter of congratulation that such good work can be accomplished under such adverse conditions.

All who are interested in life insurance records, in the identification of criminals, in civil service examinations for firemen or policemen, and in many other departments in which the question of personal identity is of importance will be interested and instructed by the articles by Gen. Alden, Maj. Adair and Maj. Brown, all bearing upon this subject.

General Oliver, of Halifax, contributes an illustrated article upon the accoutrements of the infantry soldier, that gives us an interesting means of comparison with those of the United States.

Much has been done in recent years to develop the soldier in a general way, and residents in New York City have recently had an opportunity to see what has been accomplished. The articles by Dr. Beyer, of the Navy, by Dr. Kulp, of the Army, and by Dr. Westervelt, of the National Guard, give a good idea of the methods by which these admirable results have been secured.

How best to render aid to the disabled during an engagement is a question that at the present time is far from being satisfactorily decided. Modern weapons have so enormously extended the danger line that most authorities have now agreed that individual instructions should be given to each soldier as to the best emergency treatment of wounds, and that each soldier should be provided with a "first aid" packet which shall be carried as an integral part of his equipment. The methods of instruction and the manner of equipment are ably presented by several writers.

It is interesting to note that one of the best articles upon "Instruction in First Aid" is written by Surgeon-Captain Rory Fletcher, of London. The regiment with which Dr. Fletcher is connected is the King's Royal Rifles, originally raised in this country in 1755 as the Royal American Regiment of Foot.

The status of the radical cure for hernia, especially when the operation of Bassini or that of Halsted is employed, is well presented by Major John M. Bannister, U. S. A. As his records include solely operations upon male adults, who, from the nature of their calling, are more prone to a recurrence than are persons of more sedentary pursuits the results obtained are exceptionally good.

The most valuable contribution to general surgery which the volume contains is the article upon Fractures of the Lower Extremity of the Radius, by Dr. Lewis Stephen Pilcher, formerly Passed Assistant Surgeon U. S. Navy. Dr. Pilcher's name has already been associated with the method of treatment of this injury which he presented to the profession some years ago. In the present article he has embodied the results of riper years of experience, and has supplied numerous illustrations. The treatment advocated has the merit of being easily applied, is simple and gives good results. Altogether the article may be be truly said to be the best one upon the subject which has as yet appeared in medical literature.

One of the most suggestive articles in the book is by Lieut.-Col. A. A. Woodhull, U. S. Army, who writes upon "Military Medical Problems." Surgeons of the National Guard as a rule have had no practical experience in the care of soldiers in battle, on the march, or even in camp. To them this article is especially valuable, for it presents in a graphic way the problems encountered by the medical officer during actual hostilities, and indicates the manner in which many may be solved.

This Association was organized in 1890. Military surgeons of any branch of the Regular service or of the National Guard are eligible. In its first volume of proceedings the work of 62 members was embodied in two papers and a small pamphlet of 32 pages. The seventh volume shows a membership of 421, it contains 37 papers, and 700 pages. The articles are of value to every practitioner, and as a copy is sent to every member, this in itself should be of sufficient inducement for every surgeon in the country, connected with a military organization, to have his name enrolled as a member.

Much of the credit of the preparation for the meeting, the arrangement of programme, and the securing of papers is due to Captain James E. Pilcher, U. S. Army, who is the Secretary of the Association, and in 1897 was stationed at Columbus. At the meeting he gave an exhibition drill of the Company Bearers of the 17th U. S. Infantry and the detachment of the Hospital Corps then in barracks, an account of which is briefly given ; he prepared a paper upon "The Lines of Surgical Aid Upon the Battle-field," and finally, in addition to this enthusiam, executive ability, and literary skill, he has assumed the rôle of editor, and has produced a volume which is a credit to himself and to the organization which he represents.

HENRY P. DE FOREST,
Captain and Assistant Surgeon,
13th Regt., N. G. N. Y.

Die Heere und Flotten der Gegenwart.*

This book, which is the second volume of a large work on the armies and navies of the present day, now in course of publication in Berlin, contains a full account of the military and naval forces of the British Empire. The part relating to the army is from the pen of a British staff officer, whose name is withheld in obedience to the regulations. After a brief historical introduction, the system of recruiting is described, all necessary details as to conditions and length of service in the army, the reserve, the militia, yeomanry, and volunteers being given. The organization of the various branches of the service, the strength of each on a peace and on a war footing, the machinery of mobilization, the arrangement of military districts, the government of the army, and the relations of the War Office and the Horse Guards are fully set forth. The training of the troops, their clothing, housing and feeding, the treatment of the sick, the provisions for the education of the soldiers and their children, religious ministrations, discipline and military law, and the training and duties of officers are clearly set forth. The author maintains that in view of the necessity of service abroad in countries where troops must become acclimatized to be efficient, universal military service would not answer the purpose for which the British army is chiefly required, that is to say, the defense of her colonies. The organization of the navy is described with equal fullness and competency by Captain Stenzel, of the Imperial German Navy, who treats the subject in a very appreciative spirit. The whole work is worth of the highest commendation as perhaps the best account of the British army and navy in existence. It should be added that it is excellently printed, and copiously and beautifully illustrated, the uniforms, flags, etc., being given in colors.

* *Die Heere und Flotten der Gegenwart*—(Armies and Fleets of the Present Day). Herausgegeben von Zepelin. Zweiter Band, Grossbrittanien und Irland. Berlin : Schall und Grund.

English-Spanish Manual.*

This is an excellent little manual taken largely from the French work indicated in the title.

For those who desire to brush up their knowledge of the Spanish language, to familiarize themselves with military terms and such phrases as are most likely to be of use to troops in the field in the countries of Latin America, and to acquire some ability to converse, or to improve what they already possess, the *English-Spanish Manual for the Use of Troops in the Field*, compiled by First Lieutenant R. G. Hill, 20th Infantry, will be of the greatest service. In addition to a few simple rules for pronunciation, the cardinal numbers, and some commonly used expressions, it contains a series of questions and answers in the reconnaissance of a road, and with reference to the principal topographical features; also a special set of questions in the reconnaissance of a railroad, of a water-course, a valley, a bridge, and a defile. Another very valuable feature is found in the vocabulary relating to military grades and employments, clothing and equipment, fortification, lines of communication, cavalry, artillery, and infantry; also questions to deserters, and general information.

The advantages of such a vocabulary, even to persons possessed of a good general knowledge of Spanish, are obvious. The book is bound as a vest-pocket manual, about $2\frac{1}{2}'' \times 6''$, in blue cloth, with flap.

The reconnaissance sheet contained in a pocket of the cover is essentially the same as that used at the Infantry and Cavalry School at Fort Leavenworth with the addition of words most commonly employed in reconnoitring.

The author endeavors to impress upon those who use this valuable booklet that in seeking information, especially from ignorant people, it is a bad plan to ask leading questions, and particularly so while using an unfamiliar language.

J. T. D.

How to Become a Trained Nurse.†

The life and work of a trained nurse, and the preparation necessary to enter the profession, are subjects upon which the physician is frequently questioned. "How can one become a trained nurse?" is a question often asked me by ladies on behalf of daughter or friend. In this volume edited by Miss Hodson will be found an answer to the inquiry.

The chapters on nursing, written by women eminent in their profession, tell not only how to become a trained nurse, but also what it is to be a nurse, what the calling means in private practice, in hospital employment, in district nursing, and elsewhere. These chapters will be valuable also to amateur nurses,—that is to every woman, who may, sooner or later, be called upon to care for the sick.

A noteworthy chapter is that on "District Nursing" by Miss Lillian D. Wald, Head of the Nurses' Settlement in New York. We learn that district nursing means trained nursing for the very poor in their own homes. The district nurse does not live in the house with the patient, or give her whole time

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* *English-Spanish Manual.* For use of troops in the field. Based on Manuel Français-Espagnol sur les Reconnaissances. Par A. Tamisey, Lieut. Col. and Jules Papillon, Professeur de la Société Militaire. By First Lieut. R. G. Hill, 20th U. S. Infantry. Published by the Hudson-Kimberly Co., Kansas City, Mo., 1898.

† *How to Become a Trained Nurse.* By Miss Jane Hodson, Directress of Nurses, State Hospital, Fountain Springs, Pa. One vol., 8vo, 266 pp. Nearly 40 illustrations. Published by William Abbatt, 31 Nassau Street, New York, 1898.

to one case, but distributes her attention according to the number and needs of her patients. Going from house to house, she not only cares for the sick, but performs many and varied services, which are not confined to nursing in the narrowest sense of the word. Her beneficent influence is exercised not alone over her patients, but extends to their families and friends, to whom she teaches the laws of hygiene, and brings also moral and social help.

Besides the chapters on nursing the book contains interesting biographies of Florence Nightingale, "Sister Dora," and other distinguished nurses, and a list of three hundred and twenty-five training schools, American and Canadian. Details of the schools are given, stating their size, rates of pay, hours of duty, length of course, requirements for admission, and other information which will be found of service in choosing a desirable school. There is also a list of sixty-five questions which are asked candidates concerning their health, educational advantages, religious belief, and their reasons or motives for wishing the education of a nurse. The numerous illustrations, mostly from photographs, are a useful addition to the text of the book.

Training schools are divided into two classes, those which are established by the hospitals and form an integral part thereof, and those which are organized independently of the hospitals, but attached to them by contract for practical instruction in nursing. The independent schools were the first to be established, but the hospital schools are now the most numerous. No uniform standard has yet been adopted, either as to methods of teaching, or length of the course. Some institutions consider three years of instruction essential, a few believe one year sufficient, while the majority prescribe a course of two years. The hours of daily work required from pupils vary from eight to thirteen. All schools have a probationary term of from one to three months, during which time the aspirant must prove herself strong, mentally, morally, and physically.

Nursing, though the oldest of occupations, is the newest of professions. It is just twenty-five years since nursing as a science was first taught in America. In 1873, almost simultaneously in New York at Bellevue, in Boston at the Massachusetts General Hospital, and in New Haven at the Connecticut Hospital, the first training schools for nurses were established. The new profession sprang up in response to an urgent need, and has proved an incalculable blessing to suffering humanity. The ranks are filled almost entirely by women. Amid all the controversies about woman's true mission, one right has never been questioned,—her right to be a nurse. Even in armies female nurses have a place. In our own army they have been employed chiefly in time of war, but in the British army, in the larger hospitals, both at home and abroad, women known as "Nursing Sisters," are on duty at all times.

The evolution of the trained nurse has been similar in a way to that of the modern soldier. Formerly any man could seize his bow or spear, and go out and fight; but since war has become a science, the soldier must be trained in order to win battles. In like manner the advancement of medical knowledge, and the revolution in surgical practice since the germ theory was first advanced in 1863, have made the trained nurse indispensable to the attainment of the best results in the battle with disease. Her training fits her to supplement the work of physician and surgeon, and gives her the skill which is to-day demanded in the treatment of every serious injury or illness.

Yet the new profession is not without its detractors. The trained nurse has

been called frivolous, undisciplined, a gossip, or worse. Among the thousands of trained nurses there may have been instances in which charges of this character were true, although with fairly good opportunities for observation we have failed to meet with any such types. To denounce trained nurses as a class is to indulge in reckless and malignant criticism, which can only be the product of prejudice, or of sensationalism.

Patrons sometimes expect too much of the nurse; that she should sit up all night, and keep awake all day, that she should have the touch of a gentlewoman, and the muscle of a Sandow. A nurse who had suffered much, declared that the patient's friends expected her to be "a judicious blend of an angel, a horse, and a steam crane."

Nursing, the old and the new, is peculiarly woman's work. Why she is best fitted to lead this life for and with the sick, it is not necessary to explain in words. Her instincts for watching and soothing and tending are wholly feminine. To these instincts she has added the science and skill of the new nursing, and follows the profession with devotion,—even to the sacrifice of her life.

J. P. K.

Prize Essay of Infantry Society

FOR 1899.

"The Infantry of the United States Army. How Should it be Recruited, Equipped, Organized, Supplied and Utilized."

Essays should be in the hands of the Secretary and Treasurer, U. S. Infantry Society, Fort Leavenworth, Kansas, before January 1, 1899.

The conditions of the competition can be learned from the Secretary.

Prize Essay—1898.

I.—The following Resolution of Council is published for the information of all concerned:

Resolved, That a Prize of a Gold Medal, together with $100 and a Certificate of Life Membership, be offered annually by THE MILITARY SERVICE INSTITUTION OF THE UNITED STATES for the best essay on a military topic of current interest, the subject to be selected by the Executive Council, and $50 to the first honorably mentioned essay. The Prizes will be awarded under the following conditions:

1. Competition to be open to all persons eligible to membership.

2. Each competitor shall send three copies of his Essay in a sealed envelope to the Secretary *on or before September* 1, 1898. The Essay must be strictly anonymous, but the author shall adopt some *nom de plume* and sign the same to the Essay, followed by a figure corresponding with the number of pages of MS.; a sealed envelope bearing the *nom de plume* on the outside, and enclosing full name and address, should accompany the Essay. This envelope to be opened in the presence of the Council after the decision of the Board of Award has been received.

3. The prize shall be awarded upon the recommendation of a Board consisting of three suitable persons chosen by the Executive Council, who will be requested to designate *the Essay deemed worthy of the prize;* and also in their order of merit those deserving of honorable mention.

In determining the essay worthy of the prize, the Board will be requested to consider its professional excellence, usefulness and valuable originality, as of the first importance, and its literary merit as of the second importance. Should members of the Board determine that no essay is worthy of the prize, they may designate one or more essays simply as of honorable mention; in either case, they will be requested to designate one essay as first honorable mention. Should the Board deem proper, it may recommend neither prize nor honorable mention. Should it be so desired, the recommendation of individual members will be considered as confidential by the Council.

4. The successful Essay shall be published in the Journal of the Institution, and the Essays deemed worthy of honorable mention shall be read before the Institution, or published, at the discretion of the Council.

5. Essays must not exceed twenty thousand words, or fifty pages of the size and style of the JOURNAL (exclusive of tables).

II.—The Subject selected by the Council at a meeting held Sept. 11, 1897, for the Prize Essay of 1898, is

"OUR WATER BOUNDARIES AND OUR INTERIOR WATER-WAYS; HOW TO UTILIZE AND DEFEND THEM; THEIR INFLUENCE IN CASE OF INVASION."

III.—The gentlemen chosen by the Council to constitute the Board of Award for the year 1898 are:

REAR ADMIRAL BANCROFT GHERARDI, U. S. N.
BRIG. GENERAL WILLIAM P. CRAIGHILL, U. S. A.
HONORABLE JOSEPH H. OUTHWAITE.

GOVERNOR'S ISLAND,
Nov. 1, 1897.

JAMES FORNANCE,
Secretary.

Announcement.

BY more than a two-thirds affirmative vote of the members of the Institution, Sec. 7, Article IV of the Constitution has been amended to read as follows :—

Sec. 7.—An entrance fee of two (2) dollars and fifty (50) cents shall be paid by each member and associate member, on joining the Institution, which sum shall constitute the dues and subscription for the first year of membership.

The annual subscription and dues shall not be less than two (2) dollars, due January 1st : Provided, that the annual subscription and dues of members and associate members who join the Institution subsequent to the adoption of this amendment shall be two (2) dollars and fifty (50) cents during their second, third, fourth, fifth and sixth years of membership.

The payment of a sum of not less than fifty (50) dollars shall constitute membership for life.—(*Adopted March* 11, 1898.)

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Initiation fee and dues for first year $2.50, the same amount for five years subsequently. After that two dollars per year. This includes the Journal.

NOTE.—Checks and Money Orders should be drawn to order of, and addressed to, "The Treasurer Military Service Institution," Governor's Island, New York Harbor. Yearly dues include Journal.

Changes of address should be reported promptly.